The Electrical Industry's Weekly Magazine April 24, 1961

Electrical World

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Second of Six Reports for 1961

Eum

Starts on p 61

Right-of-Way Clearing Technique is Suited to Each Locale

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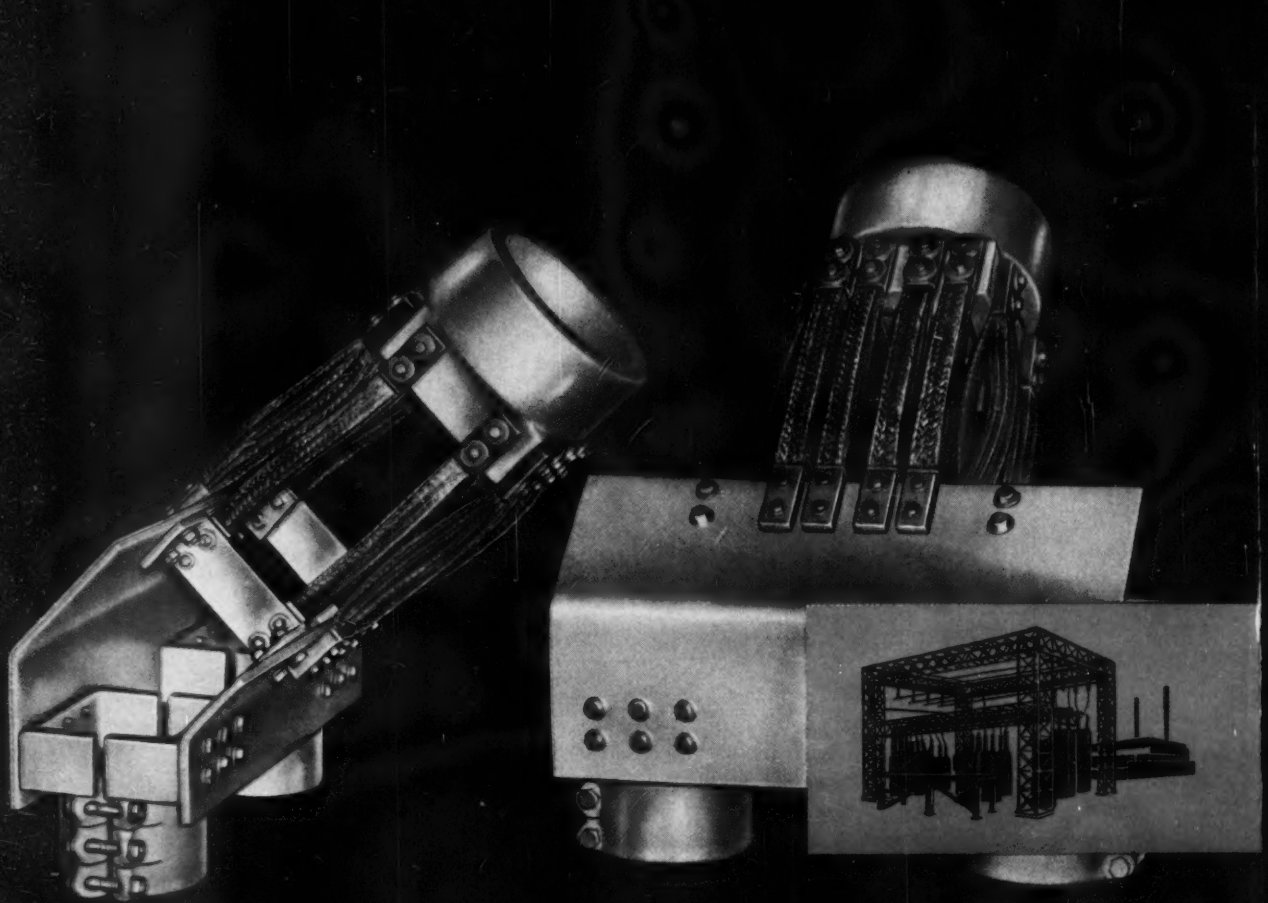

BURNDY DESIGN

Where standard connectors can't do the job, Burndy designs "specials." Shown here is one of three Burndy connectors designed to save 100 lbs. each in weight. Linking aluminum bus to copper studs of 220,000 kva transformer, connectors are flexible, have 45° angle so stud portion can be swung aside when necessary.

concentrates

ON DEVELOPING BETTER ELECTRICAL CONNECTIONS

From generator bus to service drop, the transmission and distribution of electricity depend on the design of the millions of electrical connectors that tie the system together. The design of Burndy connectors is based on 35 years experience with utility practices and with the electrical and mechanical design principles essential to produce dependable electrical connectors.

Burndy has concentrated its extensive design, research, test and production facilities on the development of better electrical connectors, standard as well as special. This unique concentration on the single objective of designing electrical connectors has produced a vast array of special connectors, like the transformer terminal unit illustrated, and whole families of mechanical and compression connectors that simplify the lineman's job, copper-to-aluminum connectors, and low cost connectors for use in great quantities.

DESIGN, RESEARCH, TEST AND PRODUCTION LEADERSHIP

BURNDY

58-17

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

APRIL 24, 1961
Vol. 155, No. 17

Dateline . . .

Who Holds Power on New Frontier?

Washington, D. C.—The first obstacle facing anyone who seeks to bring his views to the federal government is finding whom he should see. Of the thousands of persons in the federal agencies, which one really wields the power in a specific area?

In our form of government, there is no doubt but that the President holds the ultimate power in the executive branch. But the many duties and responsibilities exercised by the federal government are much too complex and ponderous for one man to administer. Thus, the person seeking to expound his views looks for a more concentrated source of power—some government official down the line who can originate actions or make decisions or propose administration policies.

Probably the greatest concentration of executive power in the past rested with the sizable White House staff under Sherman Adams during the Eisenhower Administration. It was that group, under the watchful eye of Adams, that put "approved" or "disapproved" on papers bound for the President.

Subsequent reports have also shown that Adams occasionally initiated action, worked out inter-agency problems, probably proposed policy. During his tenure in the White House, Adams was plainly a prime source of power.

Advent of the Kennedy Administration seems to have largely dispersed the power of the White House staff. The staff still serves to gather and reconcile views from the various departments, and President Kennedy himself occasionally takes a hand. But it is generally believed in Washington that the individual cabinet member is now a prime source of power.

For instance, when the White House staff set about preparing the President's message on natural resources, it called upon each of the departments involved to furnish material for the speech: Interior, Agriculture, the Army Corps of Engineers, the Atomic Energy Commission. The job of the White House staff was mainly one of editing and reconcil-

(*Continued on page 5*)

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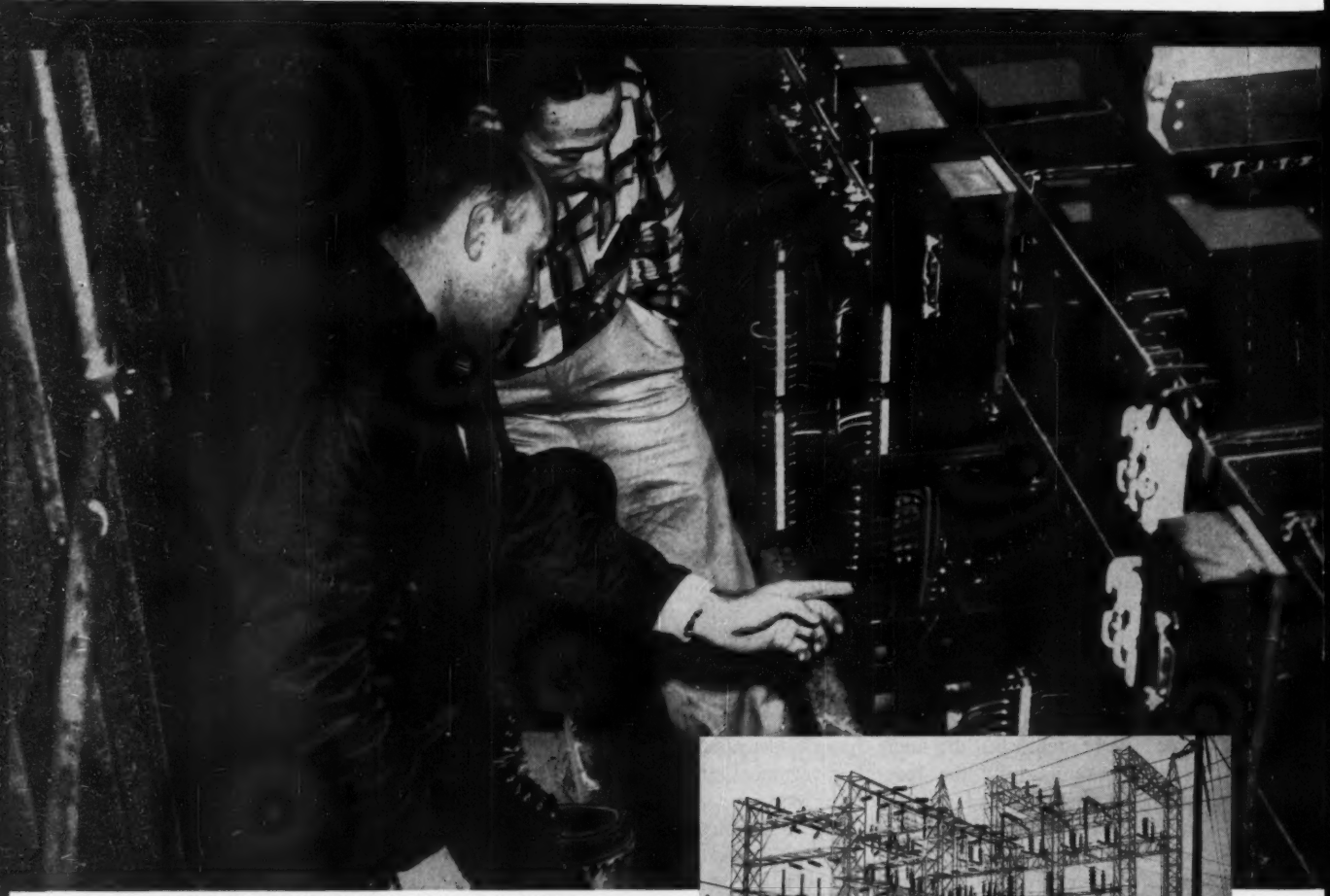

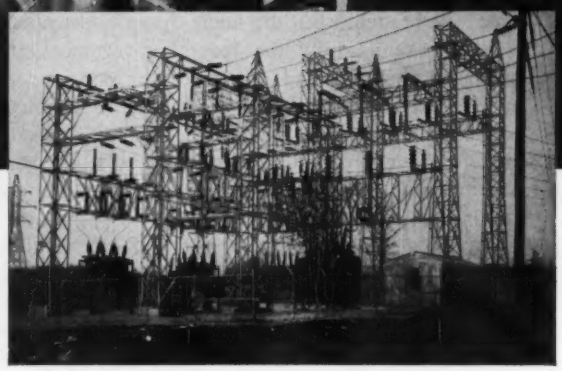

CARL SHOLAR AND KEN WEST of Kentucky Utilities, who supervised installation of all cables at the new Walker Substation, examine terminations of some of the Okonite control cable in the station. In the foreground, Mr. Sholar points to Okolite-Okoprene aerial cable which goes to the Earlington Substation.

Kentucky Utilities chooses Okonite control cable on basis of performance record

Kentucky Utilities chose Okonite control cable for its new 161 to 69 kv substation one-half mile west of Earlington, Kentucky, and used it in many ways . . . underground in ducts, in conduit and aerially on a messenger.

Okonite's service record in other Kentucky Utilities installations was the prime factor in specification of the control cable for Walker Substation. Time after time, in recent years, the utility has purchased Okonite control cable because of satisfaction with its performance.

Another important factor to Kentucky Utilities was that Okonite manufactured the cable with colored neoprene on each conductor for easy coding. (Included in the installation at Walker are Okolite-Okoprene aerial control cables, Watertite-Okoprene control cables and Okoseal 200 PVC insulated switchboard cable.)

Okonite Cable'bility* can help *you*, too, in meeting the exact requirements of your job, from manufacture through installation. To help you specify the best cable for your important power and control needs, contact your Okonite representative or write for Bulletin EW-1117, "How To Choose Insulated Cable." The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J. 8140

*OKONITE Cable'bility . . . cable craftsmanship since 1878

***where there's electrical power . . . there's* OKONITE CABLE**

Electrical World

Dateline . . .

Washington, D. C. (*Continued from page* 3)
ing the views of the various governmental departments involved.

It is possible to trace most of the policies enunciated in that message right back to one of these departments. Of course, Theodore Sorenson, the President's youthful special counsel, probably did the final phrasemaking, and the President himself made some deletions, but the policies and material originated in the key executive departments.

It was Interior Secretary Stewart Udall who briefed key Administration officials on the contents of the message the night before it went to Congress.

As things now stand, the cabinet officers now become substantial sources of power in their own departments. As long as they can originate and administer policies within the rather broad framework of general Administration policy, it seems likely they will retain that power. But once they run into political difficulties, they risk losing a part of their powers.

At Interior, the man to see is Secretary Udall.

On rural electrification matters, the power may rest for the present with John A. Baker, director of agriculture credit services. But this is because Agriculture Secretary Orville Freeman is concerned with large and pressing agriculture matters in other fields. It may be that this source of power may eventually come to rest in hands of Rural Electrification Administrator Norman Clapp, but he is a late-comer on the scene.

On nuclear power matters, it is much harder to trace the source of power and influence. The five-man Atomic Energy Commission initially disperses the power source. There is not much indication yet that Chairman Glenn T. Seaborg is intensely interested in electric power matters. It is a better bet that the person to talk to at the Commission is at staff level.

Letters

'Farber Method' Not New

To the Editor:

I refer to the article, "Determine Potential Transformer Accuracy Graphically" (EW, Feb. 6, p 46).

The technique described in this article is a very useful one and it is gratifying to see such a direct presentation of it published. However, I should like to clarify the impression that the "Farber method" is a new technique. It is merely a re-presentation of a graphical analysis of instrument transformer errors which has been in widespread usage for some considerable time. This is evidenced by the technical literature. Many will recognize the method as the Möllinger and Gewecke diagram and some as the Baker diagram for voltage transformers.

K. M. Mitchell, P Eng,
Electrical Research Department,
Hydro-Electric Power Commission of Ontario

More About Loss Factor

▶ J. B. Hodtum advises that the definition of *load factor* in his recent letter (EW, March 20, p 5) contained a typographical error and should read *"the average load divided by the peak load."* He also assures EW that his *"50.2% of rated copper loss . . . when peak load increases from 85 to 170% of rating"* denotes the relationship between copper loss at name-plate loading and the composite when a transformer serves a cyclic load whose peak grows from 85% to 170% of rating.

Don't Care About Contents Page

To the Editor:

Regarding your discussion and comment (EW, Mar. 6, p 3) on the contents page, it is o.k. with me as is. In fact you could delete the table of contents as far as I'm personally concerned because I read EW cover-to-cover anyway.

J. P. Harding
Tell City Electric Department
Tell City, Ind.

ELECTRICAL WORLD
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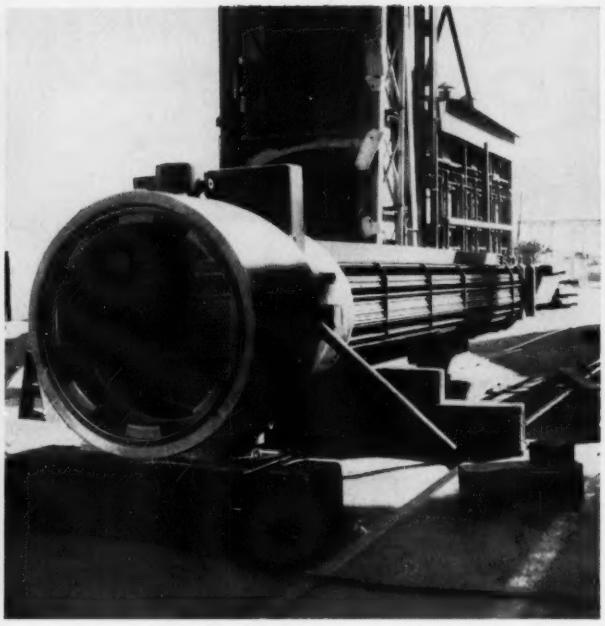
Using special type gun, average operator can make completely tight tube weld in less than 15 seconds.

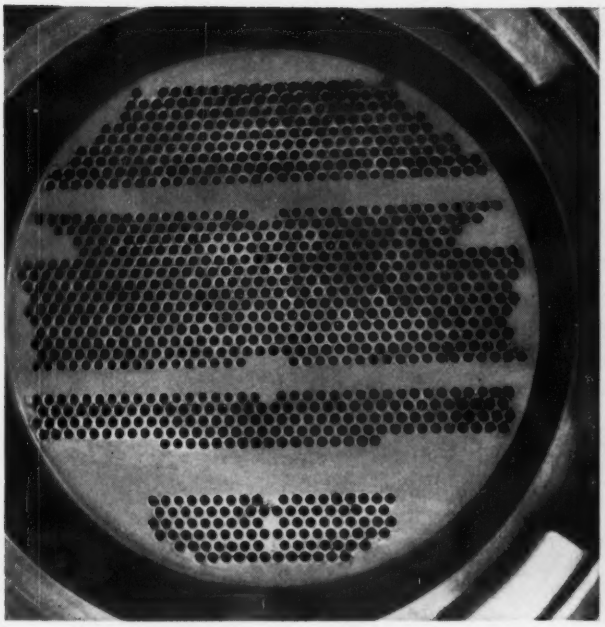


Head-on view of unit. Cufenloy-30 tubes are fabricated by special Phelps Dodge drawing and heat-treating process.

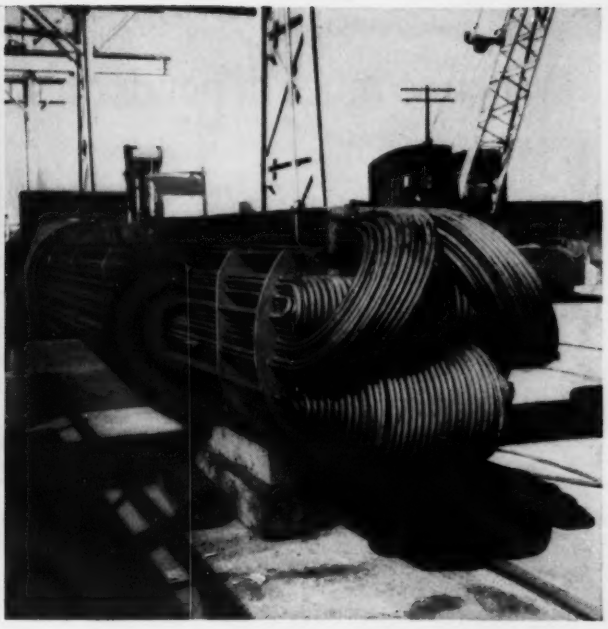
PHELPS DODGE CUFENLOY-30 DUAL GAUGE TUBES WELDED INTO FEEDWATER HEATERS

U-bent units combine new high strength alloy tubes and new tube jointing technique for superior heat transfer efficiency and dependability

Photographs: Courtesy of Southwestern Engineering Co.



Close-up of tube sheet shows welded-in tubes in place. Incomplete or unsound welds are easily corrected by re-welding.



Rear view of high pressure feedwater heater unit shows configuration of Cufenloy-30, U-bent Dual Gauge tubing.

Dual Gauge tubes of Cufenloy-30, the new and weldable, drawn, stress-relieved copper nickel alloy developed by Phelps Dodge, have been welded into high pressure feedwater heaters constructed by Southwestern Engineering Co. for a West Coast utility.

Cufenloy-30, containing nominally 70% copper and 30% nickel, is approved under the ASME Code, Case No. 1266, for unfired pressure vessels. This new alloy offers improved properties for OEM and retubing at a lower cost per bundle, yet without sacrifice of safety when substituted for 65/35 nickel copper alloy tubes. The Dual Gauge process provides a heavier wall thickness to compensate for thinning on outer portions of return bends.

Specially designed Phelps Dodge welding guns were used to weld these tubes to the tube sheets. This advanced method assures tighter tube joints with more positive, permanent protection against leakage. The guns are controlled by preset relays and timers that start, stop and regulate electrode motion, welding current and argon flow.

Whatever your tubing or re-tubing requirements, call on Phelps Dodge for highest quality products, research and technical advisory service—a complete program backed by more than 40 years of experience in the heat exchanger and condenser tube field.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
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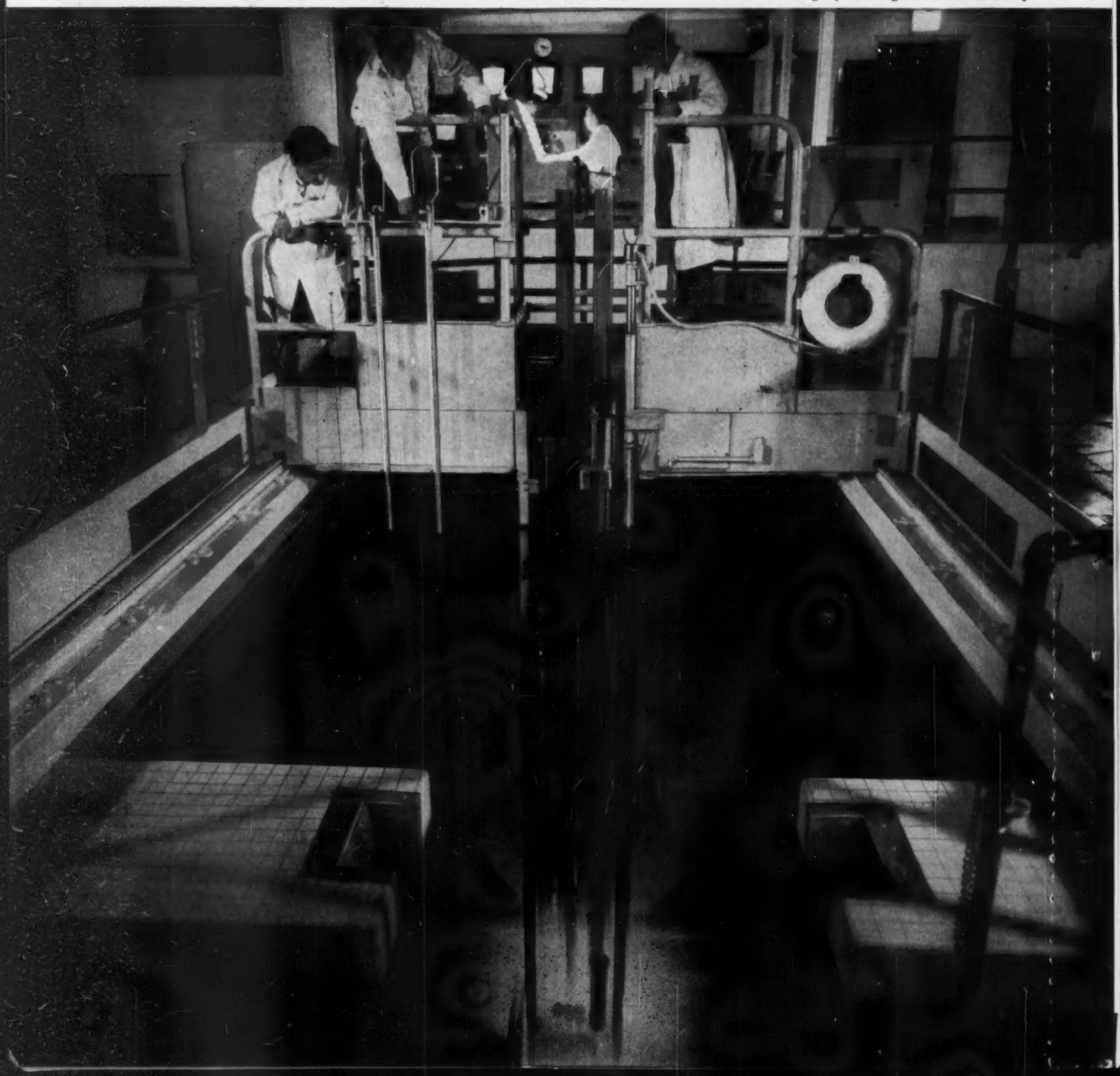
When so much depends on so little, it pays to rely on the best

. . . especially when instrumenting a nuclear reactor. The reactor shown, for example, is only one of the many reactors whose safety requirements are ideally met by a Leeds & Northrup control system.

For information on the *best* in reliable nuclear reactor control systems, call your nearby L&N Field Engineer, or write to 4938 Stenton Avenue, Philadelphia 44, Pa.

LEEDS & NORTHRUP *Pioneers in Precision*

Ford Nuclear Reactor at the University of Michigan Phoenix Project



"THE SHAPE OF THINGS TO COME"...

in new hydraulic lifting and digging equipment
designed especially for the
electric utility industry!

Watch this space in next week's
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when and where you can see

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VACUUM FAULT INTERRUPTERS

are the circuit breakers of the future—light-weight, maintenance-free and space saving. These Vac-Rupter® Interrupters can be adjacent to either end of a disconnect switch on the same steel. 1½ cycle maximum interrupting time. Shatter-proof, oil-less, non-inflammable, arcless, explosion-proof. Modular design for easy upgrading. Other exclusive features are described in detail in Bulletin 50-201. *Patent No. 2,915,611.*

HI-VOLTAGE EQUIPMENT COMPANY

Division of Joslyn Mfg. and Supply Co., Chicago, Ill. • 4000 East 116th Street, Cleveland 5, Ohio

Industry-proved through a quarter century of service . . . **THERE'S NO DOUBT ABOUT NEOPRENE**

Throughout New York City's most severe winter in many years, cable pulling for the new lower level addition to the George Washington Bridge continued with few interruptions. Even sub-zero cold does not impair the pliability of neoprene jacketing. Power cable supplied by Hatfield Wire and Cable Division, Continental Copper and Steel Industries, Inc.

NEOPRENE JACKETED CABLE TO LIGHT NEW LOWER LEVEL OF GEORGE WASHINGTON BRIDGE

Chosen for its outstanding weather resistance and time-proven reliability, jacketing of neoprene synthetic rubber will protect all the power cable used to illuminate the new 6-lane lower level of the George Washington Bridge. Much of the original electrical cable installed on the bridge's upper level is being replaced too . . . and this new cable is also jacketed with neoprene.

Neoprene's widespread use for such important jobs is backed by more than 25 years of dependable service in the wire and cable industry. As a jacketing material, neoprene is tough and abrasion resistant. Combine these qualities with its inherent resistance to weathering, temperature extremes, flame, hot and cold flow, and you have the important reasons why neoprene jacketing means long, reliable protection for electrical cable. For your free subscription to the WIRE AND CABLE CASEBOOK, containing news about applications of neoprene in the electrical industry, write: E. I. du Pont de Nemours and Co. (Inc.), Elastomer Chemicals Department EW-4, Wilmington 98, Delaware.

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NEOPRENE
SYNTHETIC RUBBER

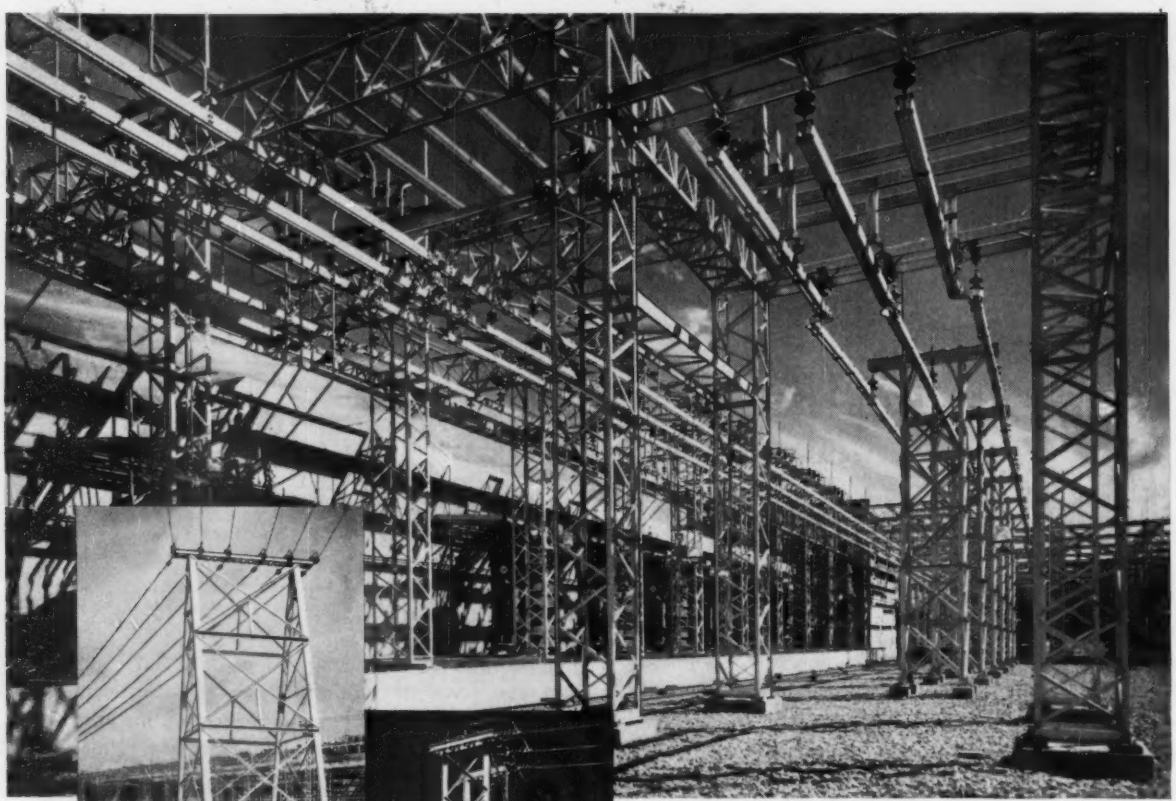
Better Things for Better Living . . . *through Chemistry*

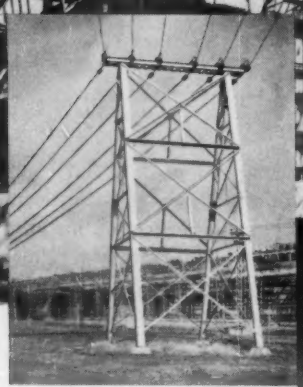
REYNOLDS ALUMINUM
"custom tailors" substations to lower your costs

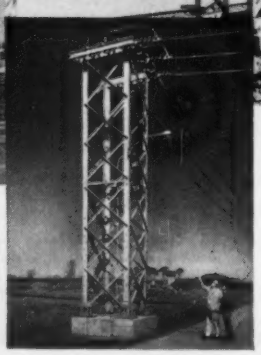
At Phoenix, Arizona, Reynolds Structural Fabricating Division is designing, fabricating and assembling structures in lightweight aluminum from the ground up, rather than merely substituting aluminum in conventional designs. Aluminum's light weight facilitates fabrication and assembly. And the strength plus light weight advantage of aluminum extrusions permit a 60 to 70% reduction in structure weight while retaining load-carrying capacities of structures made of heavier materials. The result: savings in metal, savings in weight, savings in shipping, handling, and erection costs.

Aluminum substations require an absolute minimum of maintenance. Aluminum never rusts. Periodic protective painting that over a period of years can cost more than the original structure is not necessary with aluminum. Also with aluminum, there's no problem of painting "hot" structures or costly shutdowns for maintenance. Corrosion-resistant aluminum structures are ideal for seacoast and industrial areas.

Reynolds can offer a complete series of standard aluminum structural shapes or design new shapes to fit your requirements. For complete information on aluminum substations that will deliver longer service at a lower per year cost, write *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Virginia.*



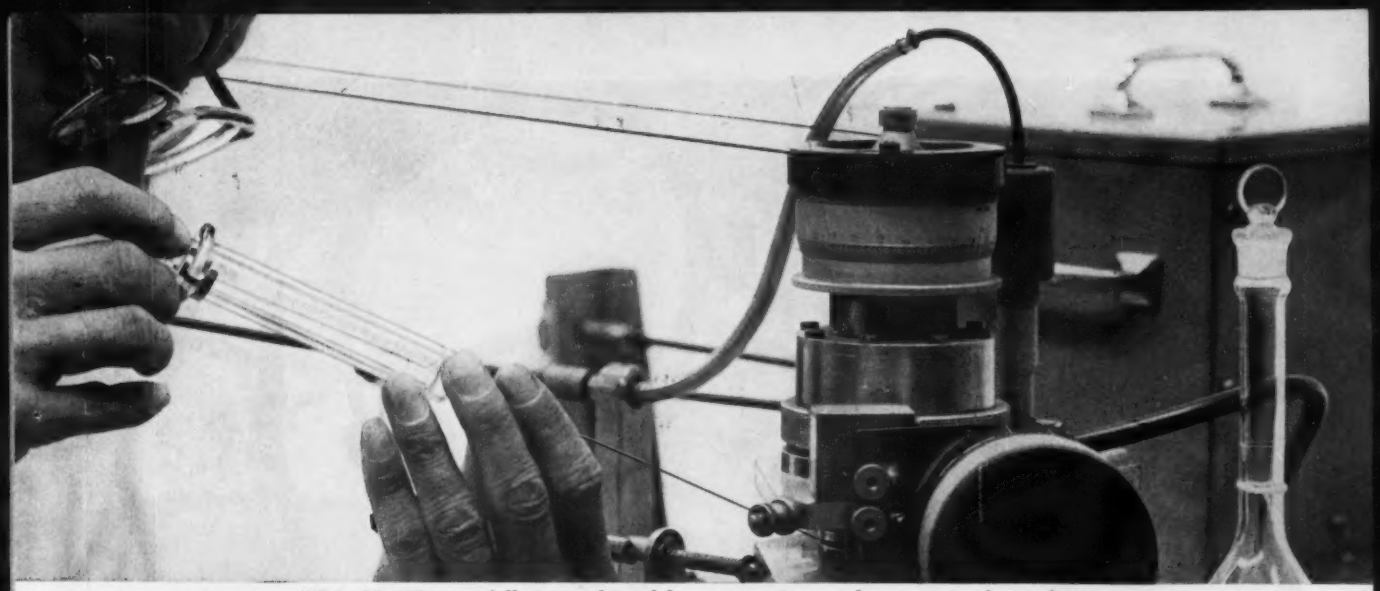




Various structural units for substations and switchyards can be built with standard aluminum structurals or structurals designed to meet specific requirements. In either case, prefabrication and assembly mean lower handling and erection costs.

Light, bright aluminum substations not only look good, but *stay new looking* without expensive maintenance.

Watch Reynolds TV show "Harrigan & Son", Fridays—ABC-TV



Diala Oil AX is carefully injected into laboratory equipment that measures electrical properties of the oil. This is one of the ways Shell makes sure that dielectric strength is high.

BULLETIN:

Shell reveals how Diala Oil AX lasts up to 5 times longer than ordinary oils

Only an oxidation-inhibited transformer oil of exceptional quality can be expected to give long service life under today's severe operating conditions.

That's why a growing number of utilities are switching to Shell Diala Oil AX. Read how Diala® AX helps them hold costs down—and how it can do the same for you.

THE DISTRIBUTION transformer is of constant concern to most utilities. It often operates outside its rated capacity during peak periods. Temperatures run high. And transformer maintenance costs are on the rise.

All of these factors have prompted utilities to search for a stable transformer oil that can help protect overloaded equipment, extend transformer life and reduce maintenance.

The answer for many utilities: Shell Diala Oil AX.

What Diala does

Diala AX contains a special Shell-developed oxidation inhibitor.

Accelerated laboratory oxidation tests show that Diala AX can provide satisfactory service *up to five times as long as* uninhibited oils.

Because of the oxidation inhibitor in Diala AX—and also because of Shell's selected base stocks and refining techniques—this remarkable transformer oil is exceptionally stable. It resists sludge formation. It helps prevent the creation of metal-attacking acids. And it reduces peroxide build-up which can damage many types of insulating materials.

Diala AX has also demonstrated an ability to extend the life of fabric insulation materials. In Shell's Emeryville, California laboratory, scientists soaked cotton insulating threads in many different oxidized oils—and for varying periods.

Conventional oils, when oxidized, weakened the thread by 25 to 40%. When subjected to the same oxidizing treatment, Diala AX had negligible effect on the thread's strength.

Diala AX has excellent dielectric properties (see photo above), good heat transfer characteristics and a very low pour point. Its low volatility reduces evaporation loss. And its flash point is high for maximum safety.

Call your Shell Representative

Ask your Shell Industrial Products Representative for all the facts on Diala AX. Or write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y.

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IN POWER PIPING ENGINEERING

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One reason why power piping systems manufactured by Kellogg are unequalled anywhere for quality is that each and every section of the system is painstakingly engineered by Kellogg before manufacture.

At Kellogg's Williamsport power piping center, the highest known engineering standards are applied to even the smallest work orders. Superior engineering supervision assures exact bending, welding, heat treating, quality control throughout . . . expedites delivery.

Maximum quality and economy on any power piping assignment are obtained when Kellogg carries this technological supervision through erection. Kellogg welcomes the opportunity to tell you more about its power piping center in Williamsport, Pa. . . . Write for new brochure.

POWER PIPING DIVISION / THE M. W. KELLOGG COMPANY

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POWER PIPING

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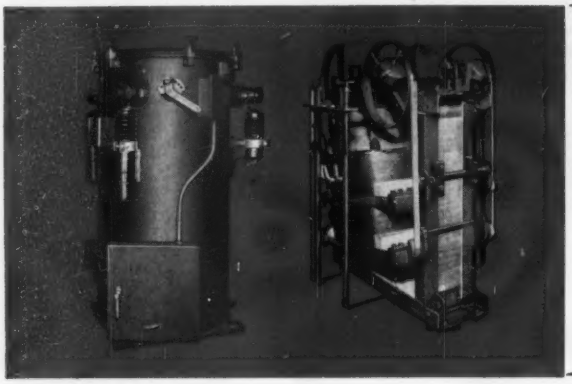
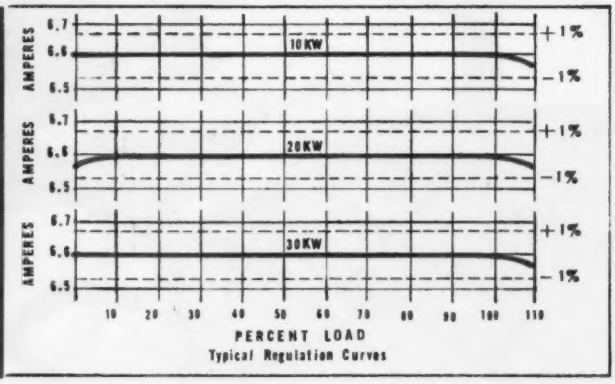
HEADQUARTERS

SPECIAL REPORT

ON SERIES STREET LIGHTING TRANSFORMERS

Moloney's Well Balanced Design For Constant Current Transformers Provides Fast, Excellent Regulation With Its Exclusive Double-Moving-Coil Construction



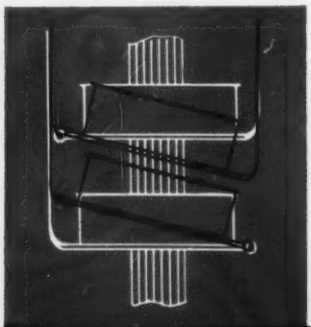


Typical Regulation Curves

Users of Moloney Constant Current Transformers benefit from the excellence of regulation under all conditions of load. This excellence of regulation stems from the exclusive Moloney Principal of Double-Moving-Coil Design. Response to current variations is faster and smoother. Coils stay parallel at all times as they move closer together or farther apart in response to circuit changes. Result: excellent regulation curve . . . less severe shocks due to short-circuit conditions.

Moloney Constant Current Transformers are available in ratings up to 70 KW. Standard rating from 5 to 30 KW. Available in Pole, Platform, Subway or Station Types and in oil, askarel or air-cooled types, depending upon the need. Additional, exclusive Moloney design features are described at right. For complete information concerning Moloney Constant Current Transformers, contact your nearest Moloney representative or write for Bulletin SL-703.

Excellent regulation curve is due to the well-balanced design of Moloney's Double-Moving-Coil construction. Coils remain parallel to each other under all conditions of load.



The exclusive Moloney Principle of Double-Moving-Coil Design permits quicker response to starting loads or changes in load, because each coil moves in ever parallel position away from, or to the other coil moving only half the distance required in single-moving-coil types of regulators.

The exclusive external adjusting mechanism permits small changes in secondary current without opening the tank.

MOLONEY ELECTRIC COMPANY

Transformers for

SALES OFFICES

ME61-12

ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

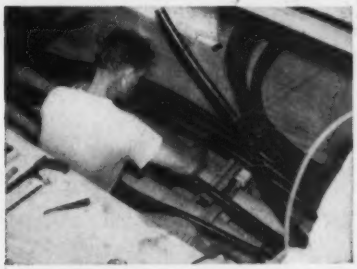
Utilities, Industry and Electronic Applications

IN ALL PRINCIPAL CITIES

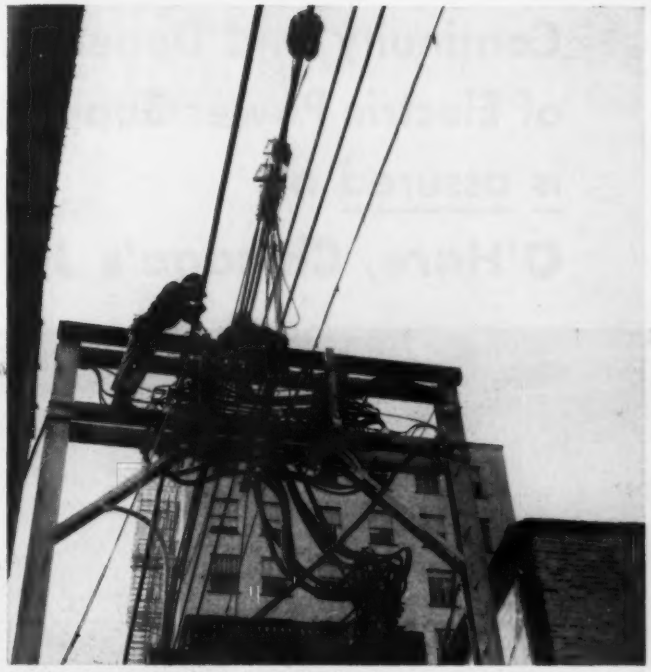
NAME YOUR CABLE PROBLEM– THERE'S A GOOD CHANCE DURASHEATH CAN SOLVE IT.

–because Durasheath's neoprene jacket and AB Butyl insulation last for years in practically any environment. Here are 5 examples.

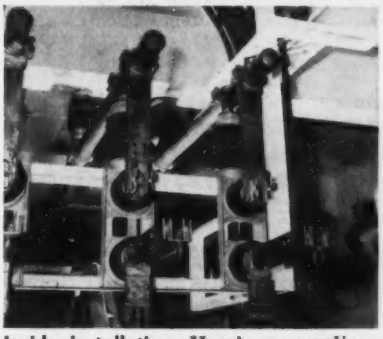
Riser Cable. In this installation, Durasheath not only serves as an aerial cable, but also as a riser cable running down the side of the building. Without additional terminations, it then drops down-inside to the plants' power-control center. It's another example of the way versatile Anaconda Durasheath adapts itself to your power cable needs.



Installed in ducts. Durasheath's flexibility meant quick and easy installation here. And once installed, its tough neoprene jacket assures long, trouble-free life. Because Durasheath adapts itself to so many uses, your inventory problems are lessened–fewer cables need be carried in stock.



Field or factory-assembled aerial cable. Durasheath may be factory pre-assembled with standard or reverse lay. Or it can be quickly field assembled with the simple spinning operation shown here. Either way, easy splicing, tapping, and terminating result in simplified installation. No cross arms or insulators are needed.



Inside installation. Here's an application where Durasheath was quickly installed and easily terminated. Durasheath's Neoprene jacket resists abrasion, heat and fumes. *Assures dependable performance and long-range economy.*

Direct-burial cable. The moisture-, oil-, and acid-resistance of Durasheath's jacket makes it the ideal cable for direct-in-the-ground applications like the one shown above. Its flexibility cuts installation time and cost because Durasheath is easy to handle. Its durability cuts maintenance costs.

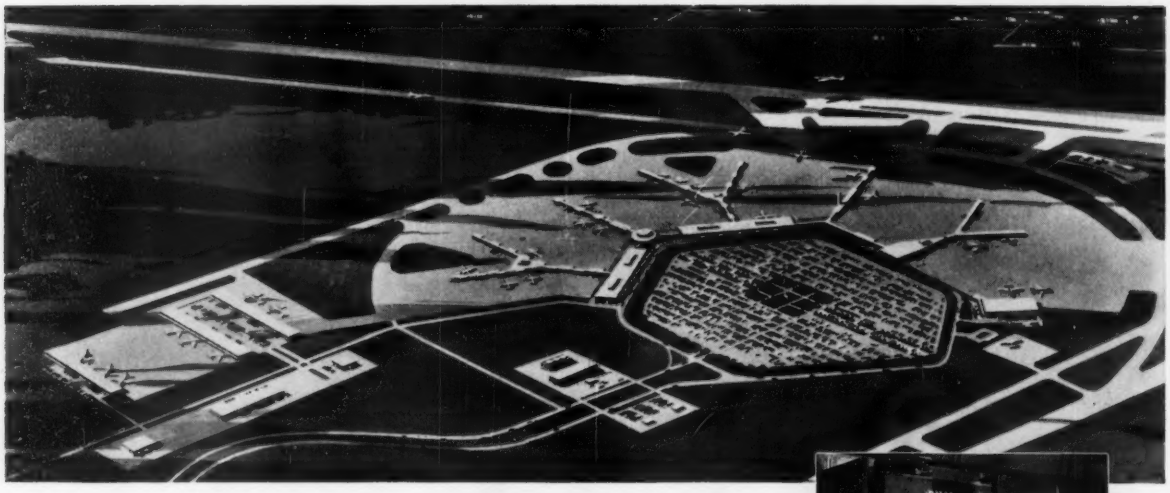
ANACONDA DURASHEATH ALL-PURPOSE POWER CABLE is available in all sizes, single and multiple conductor, copper or aluminum, 600 to 35,000 volts. *Insulations:* Type RHW, Anaconda ANW, AHW, or AB butyl rubber compounds; each designed for specific purposes. *Jacket:* specially compounded neoprene with high resistance to flame, oil, acids, alkalies, sunlight, and ozone. Has high tensile strength and is flexible over a wide range of temperatures.

For complete information about Anaconda Durasheath contact Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York, Department EFL-1-EW.

61266-C

ASK THE MAN FROM
ANACONDA®
FOR DURASHEATH ALL-PURPOSE POWER CABLE

Continuity and Dependability of Electric Power Supply is assured at O'Hare, Chicago's Jet Airport



G&W Switches play a significant role in the 'round-the-clock operations of Chicago's multi-million-dollar O'Hare International Airport. Radio, radar, runway lights, and dozens of electronic devices must never fail or be affected by power interruptions if safety and operational efficiency are to be maintained.

All electrical feeds to these critical areas are in duplicate to assure continuity of power. Vital functions such as control tower equipment and runway lights are switched automatically from any feeder, even temporarily in trouble, to the spare feeder with hardly a blink in the lights.

G&W Automatic Transfer Switches on main incoming service and service to control tower runway lights keep communications and lighting facilities operating to maintain the needed power to guard lives, effect safety, and sustain ten-mile-per-minute jet operations. G&W Manual Switches provide flexibility on other parts of the system.

These same measures of switching dependability are inherent to every G&W Switch – records of accomplishment that can be applied to the most rigorous of power requirements. Your G&W Representative is exceptionally well qualified to counsel on every switching need whether standard or specialized in nature. He is at your service without obligation.

George Lenahan, chief electrician at O'Hare, checks G&W automatic transfer switches, above, on feed to control tower and runway lights, below, on main feed to airport terminal building. Above is artist's concept of how Chicago's jet airport will look in the future.

G&W ELECTRIC SPECIALTY COMPANY
3500 WEST 127TH STREET • BLUE ISLAND, ILLINOIS
Canadian Mfr. • Powerlite Devices, Ltd. • Toronto, Montreal & Vancouver

superior quality standards – inspired specialized design

D61-1

Electrical World

APRIL 24, 1961
Vol. 155, No. 17

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NEXT WEEK

EW COVERS CORNELL'S EHV cable field-tests in a special nine-page report.

The Electrical Week

FUTURE NEWS ▶ **Look for negative report on Passamaquoddy** from International Joint Commission.

LATE NEWS ▶ **New criterion for evaluating co-op loan requests** is set by REA Administrator Clapp. Anything necessary "to strengthen the ability of the systems to remain intact" will win approval. Clapp says it isn't enough "to judge the desirability of new generation and transmission starts from standpoints of adequacy, dependability, and low cost alone." His new "security" criterion will be used "as long as co-operatives across the nation are under fire from commercial power suppliers."

WPPSS files today an alternate license application with FPC for the High Mountain Sheep site, presently advocated by Pacific Northwest Power. The action looks toward 1964 when a decision may be made whether fish facilities have been developed to permit Nez Perce construction, or whether fish facilities haven't been developed and power needs require construction of High Mountain Sheep. In either case, WPPSS will be covered.

Senate Commerce Committee isn't finished with FPC nominee Swidler. He's asked to return to the full committee on May 2, for further public hearings. Another Kennedy nominee, Howard Morgan, won't come up for approval until the May 2nd meeting.

PP&L shareholders are almost unanimous in approving merger with COPCO. COPCO stockholders agree to accept six PP&L shares for five of their own. Applications for approval are out to five state commissions and the FPC.

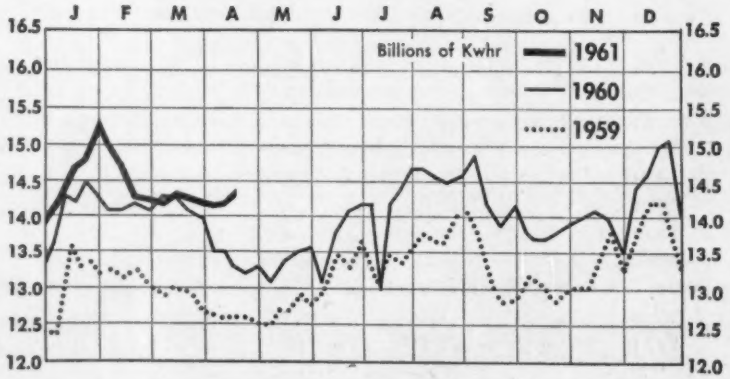
Preliminary tests are underway at Applegrove EHV testing station. The station, near Huntington, W. Va., was energized on April 13.

House hearings on Burns Creek project match Interior Department officials against spokesmen for investor owned-utilities. Utah P&L president E. M. Naughton hits Interior's claim that Burns Creek is needed to pump irrigation water. Pointing out that 30,000 acres have already been irrigated using UP&L power, Naughton claims that whole area will be under cultivation before Burns Creek could be completed.

Died last week—Harry B. Munsell, Chairman of the Board, Kansas City P&L.

Weekly Power Output posts the biggest gain since week ending Feb. 4. Central industrial region shows first positive figure since that date.

WEEKLY POWER OUTPUT—Up 6.0% (Week ending Apr. 15), Kwhr 14,434,000,000



Percent Change From Previous Year

	Apr. 1	Apr. 8	Apr. 15
Total U. S.	+ 1.9	+ 2.4	+ 6.0
New Eng.	+ 1.6	+ 2.5	+10.0
Mid. Atlan.	+ 2.1	+ 0.9	+ 8.1
Cent. Indust....	− 3.0	− 3.5	+ 2.3
West Cent.	+ 3.8	+ 4.3	+ 8.2
Southeast	+ 2.6	+ 5.7	+ 7.7
South Cent.	+ 6.6	+ 3.5	+ 2.6
Rocky Mount...	+11.2	+ 8.5	+ 8.1
Pacific			
NW	+ 1.9	+ 6.0	+ 2.4
SW	+ 5.4	+ 7.0	+10.4

Seasonally Adjusted Index 291

Week Ago 285 Year Ago 271

Source: Edison Electric Institute

Supply Lines

INTERIOR DEPT INSTITUTES NON-COLLUSIVE BID CERTIFICATION

The US Interior Dept, whose Bureau of Reclamation is now mulling over what to do about recent identical bids it received on ACSR cable (EW, April 17, p 16), has ordered that contracts for materials, supplies, and equipment must now contain certificates that bids were reached independently and without collusion. It is the first official act of a federal agency to move against identical bidding since President Kennedy said a few weeks ago that he would order federal agencies to publicize all identical bids received. The clause to be inserted reads:

"Non-collusive bidding certification. By the submission of this bid, the bidder certifies that: (a) The bid has been arrived at by the bidder independently and has been submitted without collusion with any other vendor of materials, supplies or equipment of the type described in the invitation for bids; and (b) The contents of the bids have not been communicated by the bidder, nor, to its best knowledge and belief, by any of its employees or agents, to any person not an employee or agent of the bidder or its surety on any bond furnished herewith, and will not be communicated to any such person prior to the official opening of the bid."

Language of this clause is similar to that used by the Justice Dept in orders against companies found guilty of price fixing. When defendants violate such an order, the Justice Dept can bring contempt action for violating an injunction. But in the case of the Interior Dept, violators will be subject to prosecution under the False Claims Act, which prohibits fraud against the government, and which can result in both fines and jail sentences.

MORE PRICE CHANGES ANNOUNCED BY SUPPLIERS

A change in published prices of small power transformers, 501 to 10,000 kva, and also for network transformers has been announced by Allis-Chalmers Manufacturing Co, effective April 17. A-C says the new prices for power transformers "are at a level higher than recent market quotations but are lower than the old published prices, depending upon kva and voltage rating." A month ago, A-C made a similar move on large power transformers (EW, March 20, p 25).

In network transformers, A-C says it is changing its multiplier from 0.49 to 0.485 for all 'Part A' transformers, and to 0.48 for all 'Part B' transformers. Accessories on both parts now have a 0.485 multiplier, the company adds.

In capacitors, Sangamo Electric Co has announced published prices of its 50-kvar units will remain at $117, but that its 100-kvar units are now $209, effective April 10. Previously, Line Material Industries went to $209 for the 100-kvar units (EW, April 3, p 14). Meanwhile, General Electric Co has made no announced change in its published price of $97.33 for 50-kvar units, although there were unconfirmed reports that higher bids were being submitted.

Price increases on fuse links and enclosed and flip-open cutouts have been announced, effective April 17, by General Electric Co. Flip-open cutouts, rated 7.8 and 15 kv, have been increased 5%, while the majority of enclosed cutouts, rated 50 and 100 amps, 5.2 and 7.8 kv, have been increased 5.5%. A few models have been decreased up to 8%, the company said. Universal cable-type fuse links,

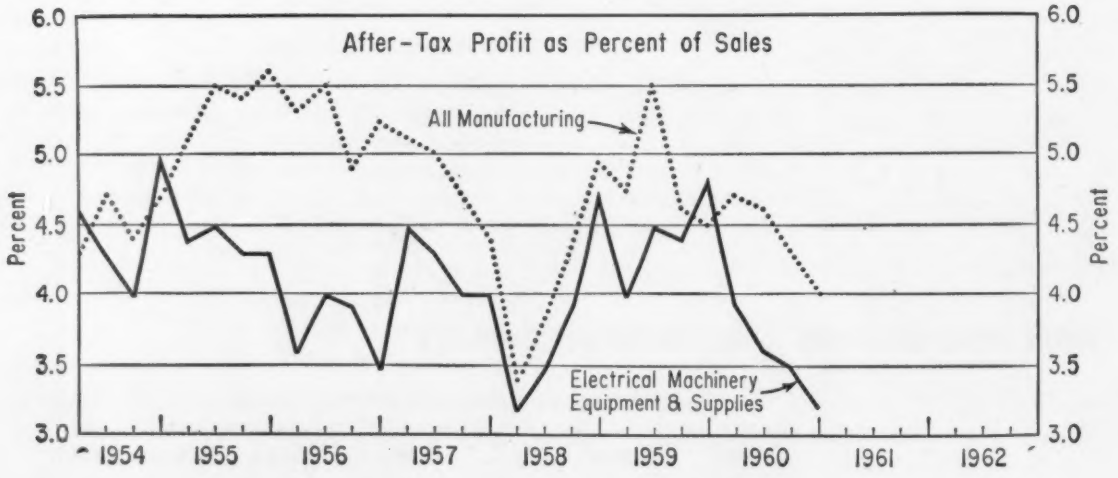
Supply Lines *Continued*

rated one through 200 amps, have been upped from 1.8% to 5%. Higher manufacturing costs were behind the increases, GE said.

SUPPLIERS' PROFITS SLIPPING FASTER THAN ALL-MANUFACTURING AVERAGE

The US government's statistics on how manufacturers' profits are doing shows that during the fourth quarter of 1960 the electrical industry slipped faster than the average of all manufacturing industries. The chart below shows how electrical manufacturers have fared during the past seven years compared to all manufacturing, and is taken from the *Quarterly Financial Report* published jointly by the Federal Trade Commission and the Securities and Exchange Commission.

Although all types of electrical manufacturers are encompassed in the "electrical machinery, equipment and supplies" category, the effects on profits of the "White Sale" of 1954-55 (abetted, probably by the long Westinghouse strike) are clearly shown. In addition, after the recovery from the 1957-58 recession, a small dip occurs, possibly caused by the short-lived price war of 1958.

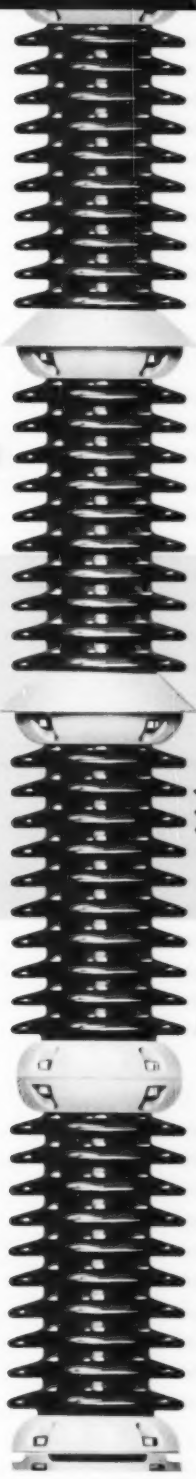


LOCOMOTIVE ANTITRUST SUIT COULD AFFECT POWER PLANT MARKET

An antitrust suit has been filed by the US government charging General Motors Corp with using its "vast economic power illegally" to monopolize the diesel locomotive industry. Should the government be completely successful, which is highly uncertain, GM could be forced to spin off all or part of its locomotive operations at the Electro-Motive division, the same division where GM makes packaged diesel power plants for utility peaking use. In fact, GM packaged power plants and locomotives consist of basically the same equipment and are made generally on the same assembly lines. (One reason GM turned to the utility market was that with the nation's railroads almost completely converted to diesel, it needed new markets for its product.) Therefore, a court decision on GM locomotives could have an effect on the company's role in the power plant market.

On its part, GM said it was not guilty of the charges and stated this would be "clearly established at the trial." It also pointed out that its leadership in the diesel locomotive field was "inevitable" as it was the innovator "while competitive manufacturers were still promoting the sale of steam locomotives."

If you buy POSTS for your station...



Check these O-B features; you'll find stations easier to design whatever the voltage

Here are big advantages you get with O-B POSTS:

- Full range of BIL ratings
- Three strengths
- Electrical characteristics exceeding ASA requirements
- Dimensions of ASA standards where applicable
- Interchangeable units in stacking post
- Greater stability in broad base of stacking post
- Effective, easy-to-install rainsheds for stacking posts
- Stacking post units that serve multiple BIL ratings

If you've designed stations using O-B posts, you'll recognize the value of many of these features. And, we're sure you would agree O-B furnishes you with an insulator that is easy to use, that will do more than a minimum job, and that will provide long-time dependability.

If you've not designed a station using O-B posts, we would suggest that you talk to your O-B representative and get acquainted with these features.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass (B) HOLAN

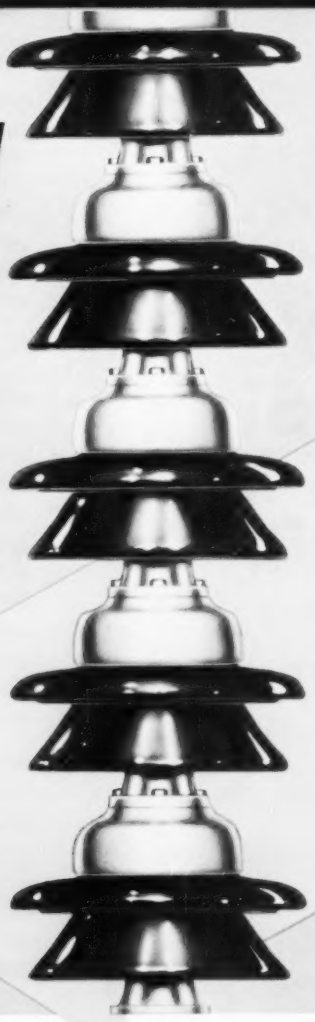
PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

10112-H

There is another side to our story... for PINCAPS

SEE NEXT PAGE

If you buy PINCAPS for your station...



Choose from O-B's complete range of pincaps from 7.5 kv into EHV

Pincap station insulation is the "traditional" design with which O-B has more than 50 years of production experience. The consistent, outstanding performance of the O-B pincap is another tradition. That is one reason O-B devotes so much time to research, design, and product application for the industry's rising voltage levels.

With O-B pincap station insulation, you can easily select an insulator or combination for all system voltages from 7.5 kv up into the extra high voltage range. Where national standards apply, O-B pincaps not only conform but exceed minimum requirements.

These switch and bus pincap insulators of the single unit design include all ratings up through 250-kv BIL in two strengths. Stacking units begin at 350-kv BIL and are generally composed of identical units. Where higher strength, high voltage stacks are needed, mixed stacks increase considerably the cantilever strength.

Your O-B representative will be glad to give you full information on O-B's station pincaps. Just ask.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Be sure to check the other side of our story... for POSTS

SEE OTHER SIDE

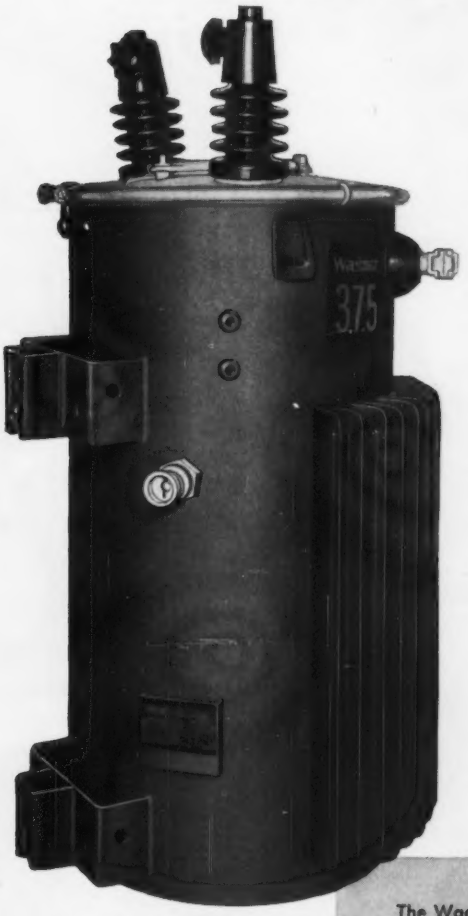
Ohio Brass (B) HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

10112-H2

Up-rate distribution voltage with minimum service interruption with the

SERIES MULTIPLE SWITCH ON WAGNER® TRANSFORMERS



The switch is available on transformers with these high voltage ratings: 2400 X 7200, 2400 X 7620, 2400 X 7970, 4800 X 7620, 4800 X 14400, or 7200 X 14400. These dual-voltage units have losses and performance values comparable to single-voltage units of the higher voltage, and are insulated for the BIL of this voltage for positive protection against puncture, flashover or lightning failure.

For use on systems that will be uprated, Wagner can furnish 5 through 167 kva dual-voltage singlephase conventional transformers or 5 through 100 kva protected transformers equipped with a series multiple switch. The switch permits the uprating of an entire section of a distribution system at one time. The line need be deenergized for only the brief time necessary to change the switch to the higher primary voltage rating. The externally-mounted weatherproof cap is removed, reversed and used as a knob over the switch shaft to rotate the switch to the alternate position. Safety is positive; the knob cannot be removed unless the high conductivity switch contacts are in full operating position. It is not necessary to change the terminal board connections. The cover stays on . . . oil is not contaminated.

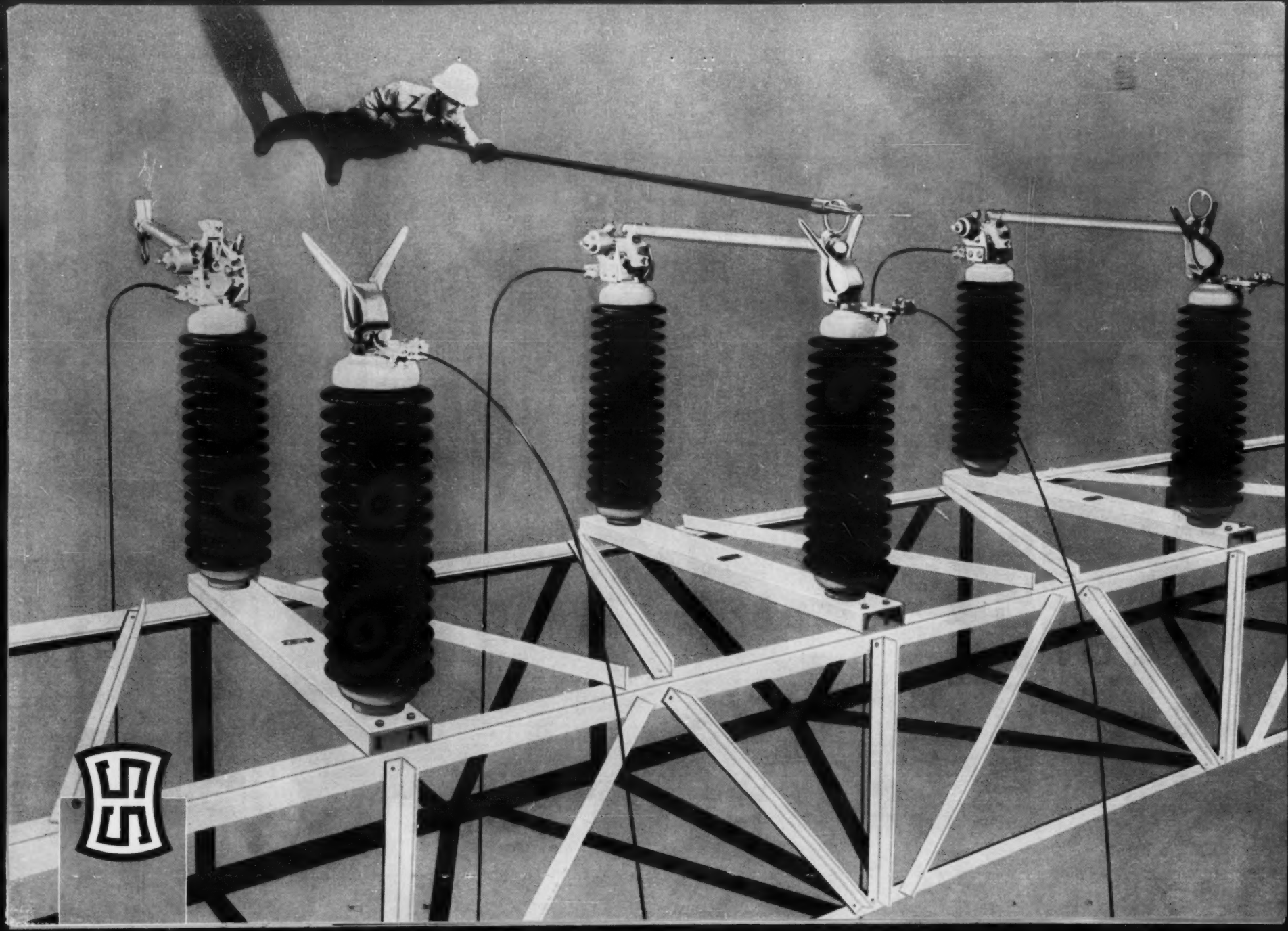
Wagner Electric Corporation
6456 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

WT60-21

The Wagner® Series Multiple Switch is a rotary-bridging two-position switch with ribs between its eight wiping-action contacts for extra creepage. All eight contacts are used for an odd series multiple, while only six contacts are required for an even series multiple . . . two pairs of contacts are jumpered. Solid mounting of the switch on the tank wall eliminates shaft alignment problems and allows fast, sure operation.

SERIES POSITION

MULTIPLE POSITION



DON'T OVERLOOK THE MECHANICAL CHARACTERISTICS WHEN EVALUATING YOUR POWER FUSES

Thermal and electrical characteristics rightfully deserve first consideration in evaluating power fuses, because the fuse must carry rated continuous current and interrupt rated short circuit currents to perform its primary function.

But from an operating and maintenance standpoint, the fuse's mechanical characteristics should not be overlooked. Here are nine of the most important features to consider:

1. **OPERATING RING** Can the fuse holder be easily disengaged from the latch? It is important that the operator have complete control over the fuse holder during the opening procedure. Southern States BPA and HPA fuses have full-circle operating rings to assure complete control.

2. **FUSE HOLDER REMOVAL** Can removal or replacement of the fuse holder be accomplished easily and simply? Special, cumbersome, rigs are objectionable to operating personnel. Southern States fuse holders are handled with a hookstick.

3. **SLEET HOOD** Are the top contacts fully protected from freezing rain, snow, or other foreign matter? Note the extra large hood on Southern States fuses.

4. **POSITIVE HOLDER GUIDE** Will the fuse holder make proper engagement with the top contact, even when closing is made from an oblique angle? Southern States fuses are equipped with generous guide arms on the sleet hood to position the holder properly, regardless of side thrust.

5. **POSITIVE IDENTIFICATION** After operation, does the position of the fuse clearly indicate that an operation has taken place? Southern States fuse holders swing to a fully open position and can be easily spotted from a distance.

6. **SHOCK ABSORPTION** After operation, does the fuse provide a sure means for bringing the fuse holder to a cushioned stop? Damage to the fuse mounting is prevented on Southern States fuses by properly designed snubbers.

7. **LINK PROTECTION** When the fuse holder is slammed closed, is there some means to prevent overstressing the link? To avoid the possibility of rupturing a link, mechanical locks on the BPA and HPA fuses absorb force transmitted through the bottom hinge assembly.

8. **RESTORING SERVICE** Is the fuse easily and economically restored to service after operating? Fuses that require elaborate replacement components to keep them in service are not only costly, but burdensome to both supply and operating personnel. A simple, inexpensive fuse kit is all that's needed to restore service with Southern States power fuses.

9. **SELF-LOCKING HINGE** When the fuse operates, are the fuse holder and fuse mounting locked together? For safety reasons and to avoid possible damage to nearby equipment, Southern States fuses are equipped with self-locking hinges.

Before you buy your next power fuses make certain they measure up in every respect. Southern States BPA and HPA Power Fuses will.

For complete details, consult your Southern States representative, or write direct to us.

SOUTHERN STATES

HAMPTON, GEORGIA

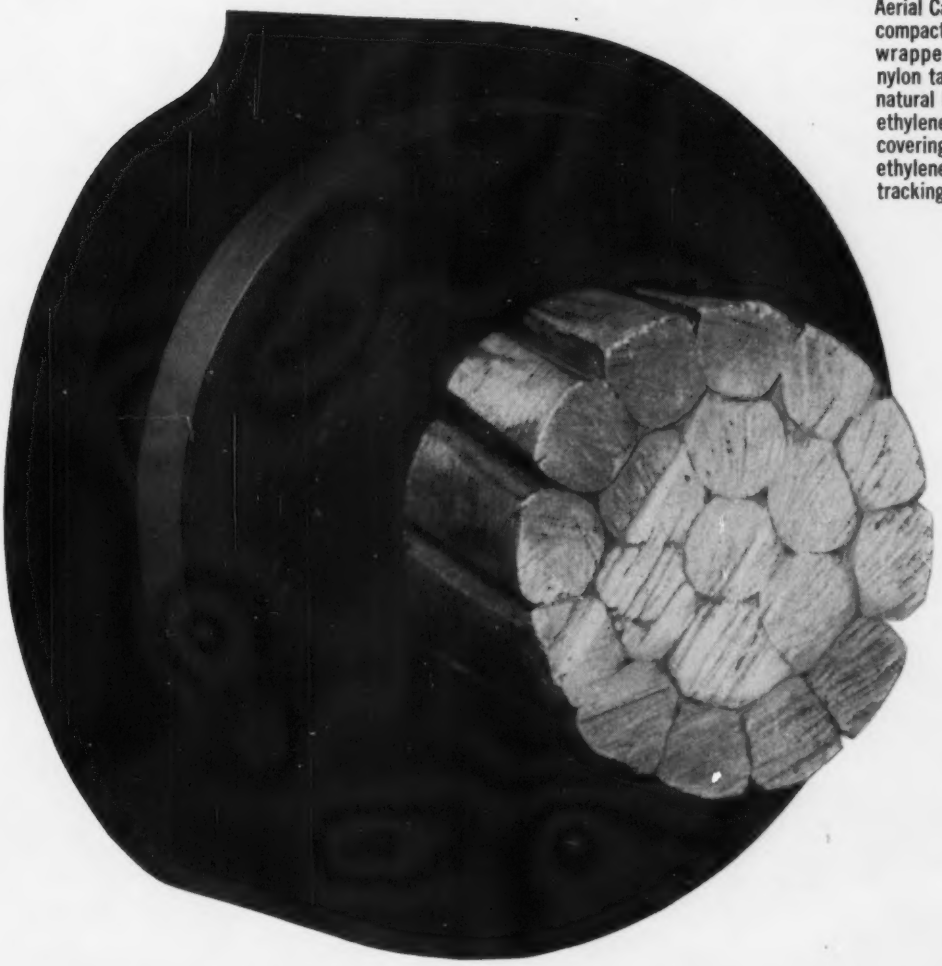
IN CANADA: DOMINION CUTOUT CO., LTD., TORONTO

1886	1910	1961
40°C RISE	55°C RISE	65°C RISE
25 KVA	25 KVA	25 KVA

Watch for the Westinghouse announcement on the new LL-65 distribution transformer soon

You can be sure . . . if it's Westinghouse

-70962



Magnified section of Hendrix 24 Kv Aerial Cable (336,400 CM 19-strand, compact-round aluminum EC-H19) wrapped with semi-conducting nylon tape and covered with .175" natural high-molecular weight polyethylene. To this is bonded a .125" covering of new high-density polyethylene that positively resists tracking.

NEW! A Cable Covering That Solves High-Voltage Tracking Problems

NEW HIGH-VOLTAGE HENDRI-CLAMPS

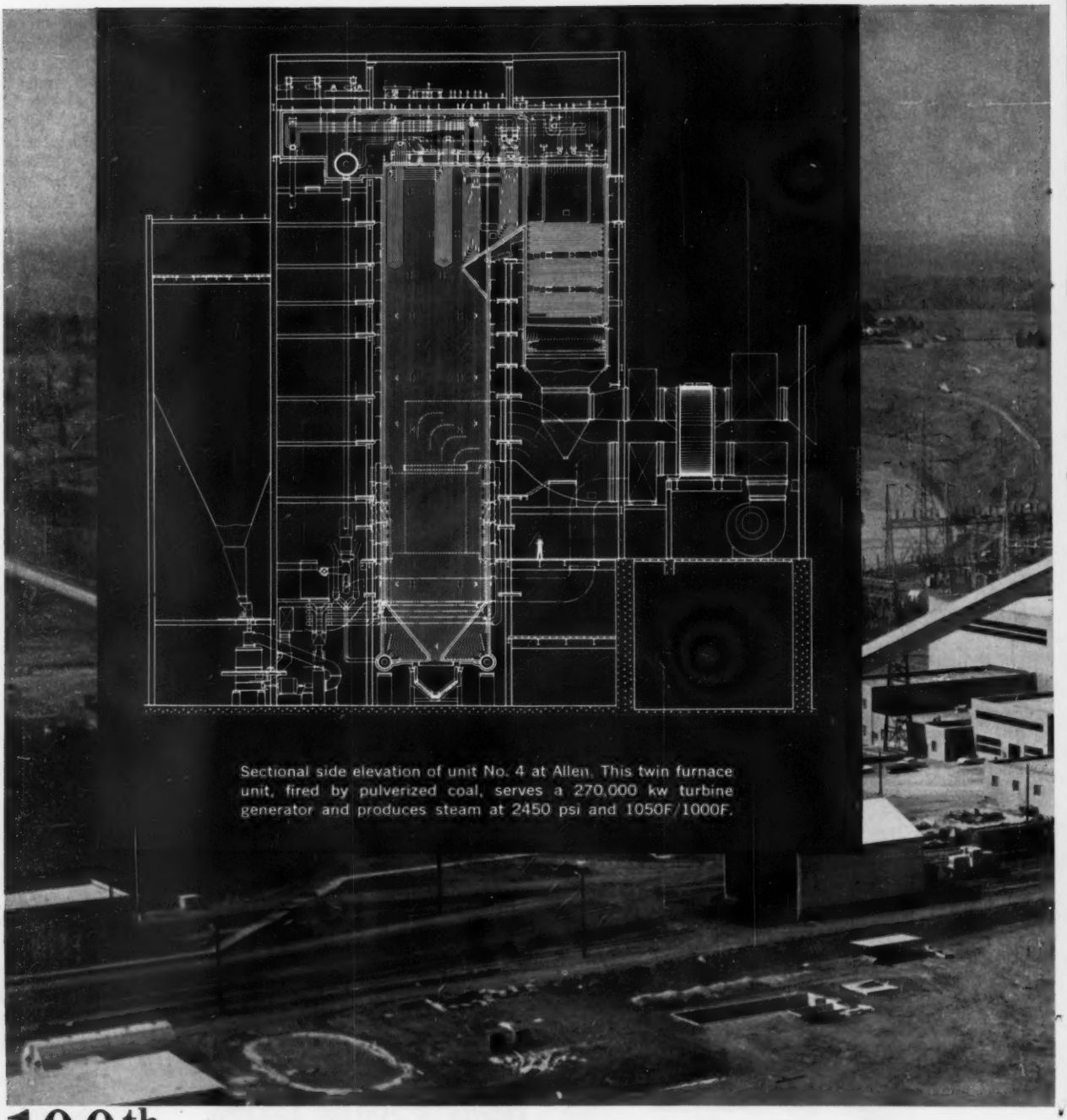
TRI-7 HENDRI-CLAMP
Easy to use. Self washing. Spaces conductors 7" apart. Will accommodate conductor sizes thru 1,000,000 CM, max. O.D. 1.5".

15 Kv VERTICAL HENDRI-CLAMP
Features inside weather washing. Minimizes ice accumulation. Easy to install. Conductors are spaced approx. 6½" apart.

...and you get it only with Hendrix Aerial Cables

At last — a new polyethylene cable covering that prevents tracking at voltages above 9 Kv. Developed by Hendrix in cooperation with the technical service department of Union Carbide Plastics Co., Division of Union Carbide Corp., this remarkable new polymer covering has proved itself in exhaustive laboratory and field tests. Let us prove to you how this new covering ends the costly troubles that arise from tracking problems. Write us for free field demonstration.

Hendrix
WIRE & CABLE Corp. MILFORD, N.H.



Sectional side elevation of unit No. 4 at Allen. This twin furnace unit, fired by pulverized coal, serves a 270,000 kw turbine generator and produces steam at 2450 psi and 1050F/1000F.

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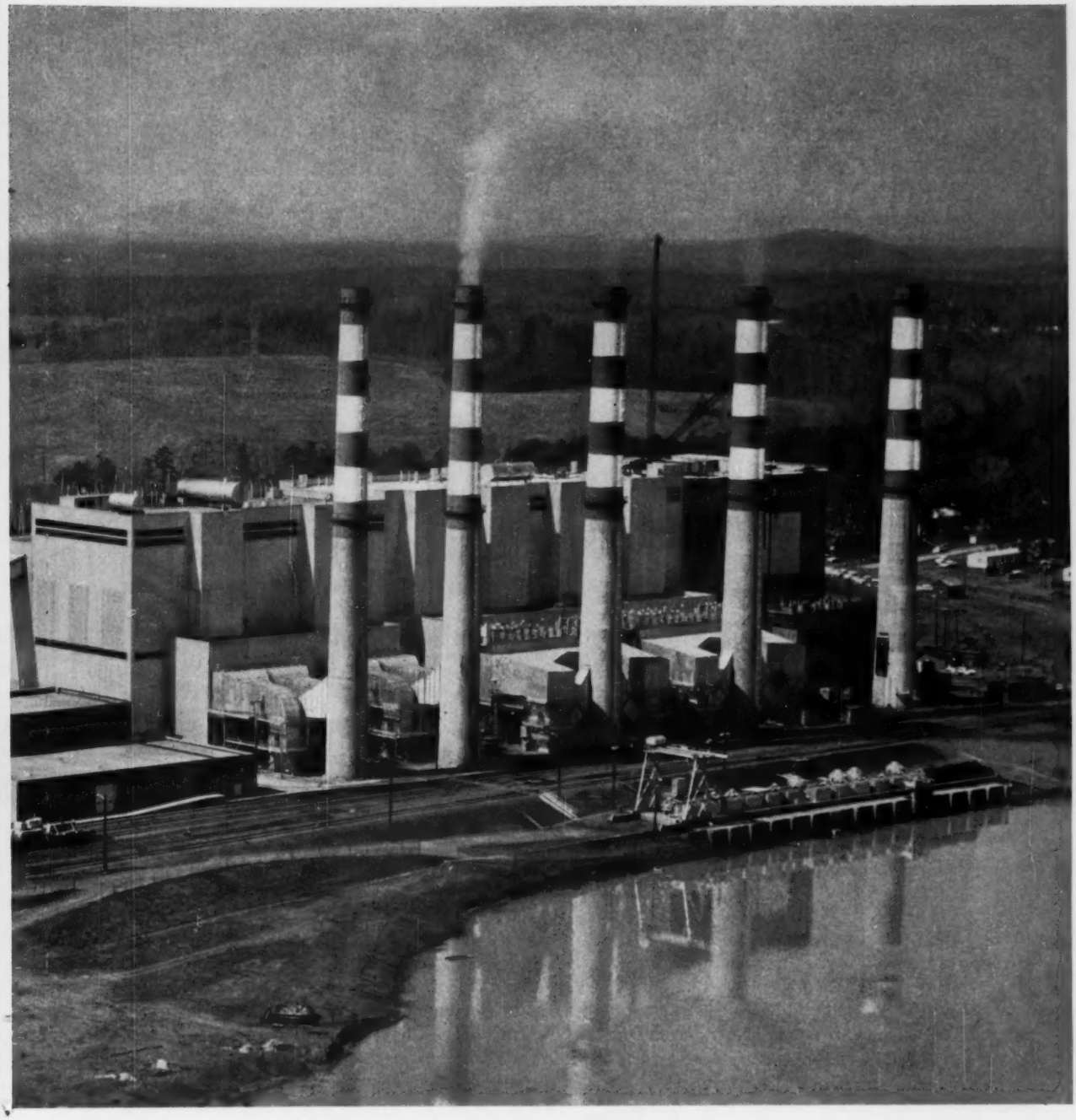
Since the first postwar C-E Controlled Circulation unit was placed in service about eight years ago, this type of unit has established itself as the design best suited for the 2400 lb throttle pressure



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range, and has achieved unparalleled acceptance throughout the utility industry. Today, units of this design are on order, under construction, or installed in utility plants the world over. The total capacity of the turbine generators served is about 30,000 mw.

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Line Material's SRT transformer has entered the final phase of product development. The SRT transformer has been successfully field-tested by most utilities throughout the nation. It has proved more than reliable in every respect.

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THE SRT TEST PLUG, right, can be used to determine if all components are functioning properly. It also permits operator to place transformer on any tap position desired should there be a reason to remove the automatic control. When the electronic control is removed, the SRT operates as a fixed-ratio transformer.

OUR 50TH YEAR · LM · 1911 — 1961

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Transformers

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PACKAGED SUBSTATIONS · CAPACITORS · REGULATORS · OUTDOOR LIGHTING · LINE CONSTRUCTION MATERIALS · PORCELAIN INSULATORS · FIBRE PIPE & CONDUIT

Residential installation of L-M Pad-Mount Transformer, showing locations of primary and secondary runs. L-M Permaline conduit permits pulling cable whenever necessary without destroying costly landscaping and driveway pavements.

Cut Long-Range Costs Of Underground With Cable In L-M Permaline Conduit

Direct burial fibre conduit makes it easy to replace cable for faults or load growth without costly damage to customer's shrubbery and driveways.

by **W. M. BLOOM**
Product Manager, Fibre Products
Line Material Industries

Long a leader in equipment for underground distribution, Line Material recognizes the cost problem for utilities. L-M has made many contributions toward cost cutting by originating the Pad-Mount transformer; with L-M Transclosures and Power Pedestals; and with a completely engineered system for fibre conduit.

While unprotected cable offers attractive savings in original cost of an underground installation, long-range cost can be substantial, when cable must be dug up because of failures, or replacements for load growth. Replacement of shrubbery and driveways can be costly; loss of customer good will is inestimable.

Cable in Permaline direct burial conduit can be pulled and replaced easily, economically. Ask the L-M Field Engineer for information and bulletins on L-M Permaline Conduit and underground distribution equipment; or write Line Material Industries, Milwaukee 1, Wis.

Long lengths, light weight, make L-M Permaline Fibre Conduit easy and economical to install. Available in 2-4" sizes, in 5, 8, and 10-foot lengths. Complete stocks at L-M Distributors and L-M's strategically located warehouses.

OUR 50TH YEAR 1901 – 1951

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Permaline Fibre Conduit

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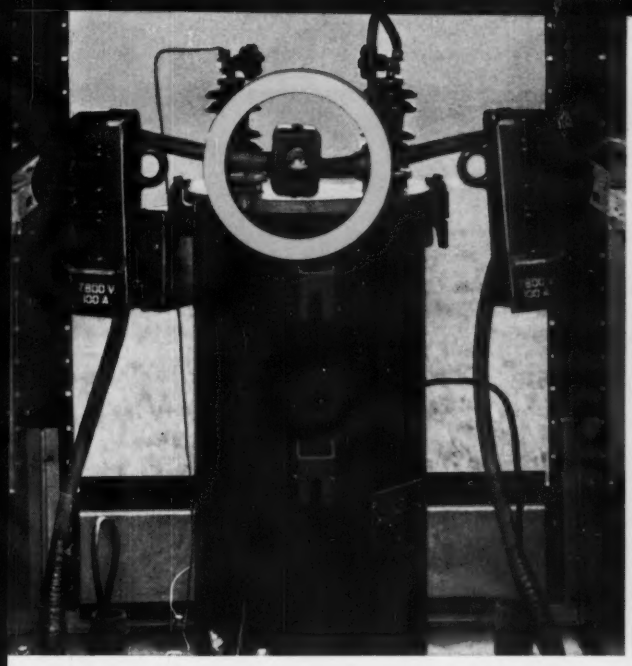

New L-M Fault Indicator mounted on the primary feeder in a transformer installation in an L-M Transclosure.

L-M Fault Indicator mounted on a primary feeder in an L-M Pad-Mount transformer. Indicator may be mounted either vertically or horizontally. To reset, just turn the handle. (Inset): Fault Indicator has tripped, exposing yellow section, showing that a fault exists beyond this point.

L-M's Economical Fault Indicator Quickly Locates Underground Faults

L-M's exclusive new Fault Indicator is a simple, inexpensive device primarily for installation on underground feeders in Pad-Mount® transformers or Transclosure™ housings. Should a fault occur, the Fault Indicator shows the general location, between adjacent transformers or sectionalizing points. One fault-hunting job could well pay for the installation of these L-M Fault Indicators.

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The Fault Indicator also facilitates location of a faulted phase of a three-phase system. Fast half-cycle operation permits coordination of the indicator with protective devices over a wide fault-current range. And it costs less than $10!

Get Details On This Money and Time-Saver

Ask the L-M Field Engineer for details, and time current curves on this valuable, economical device. Or write Line Material Industries, Milwaukee 1, Wisconsin.

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Please have L-M Field Engineer tell me how I can save time and money with the L-M Fault Indicator.

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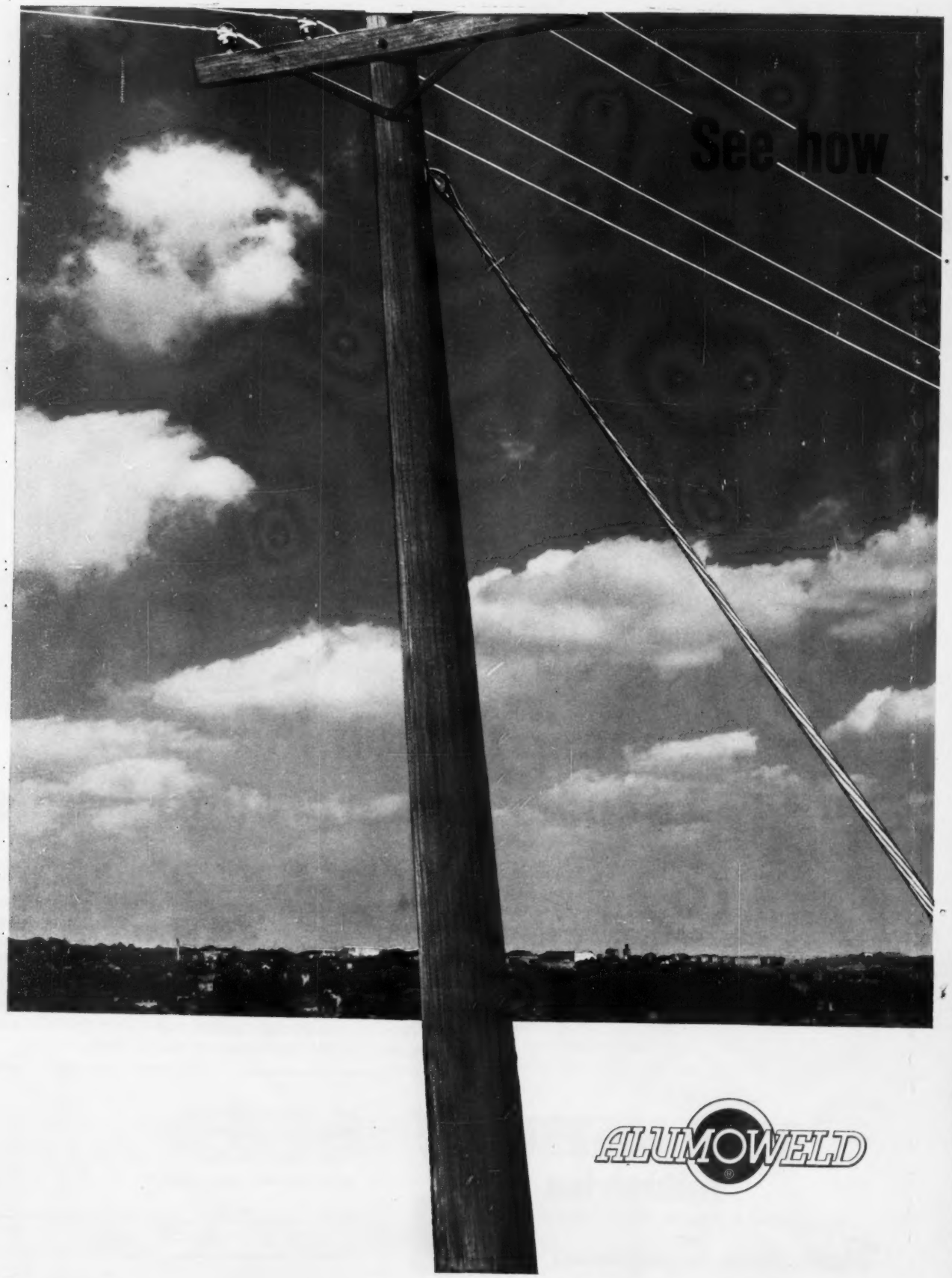

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can fill your requirements for guying installations...

ALUMOWELD, made by the controlled atomic-welding process, combines aluminum and steel to give you strand with *permanent* high strength. The following facts tell you why Alumoweld should be your choice for guying installations.

STRENGTH—Alumoweld has a higher strength-to-weight ratio than any other strand used on overhead lines. Size for size, Alumoweld has the same tensile strength as extra-high-strength steel . . . weighs 18% less . . . and will last far longer.

CORROSION RESISTANCE—a *thick* cladding of pure aluminum—25% by area—gives Alumoweld the same long life and high resistance to corrosion as solid aluminum.

EASIER TO INSTALL—Because of its lighter weight, Alumoweld is easier to handle so installation is faster. Dead-end fittings and other accessories are available from suppliers.

LOW COST—Alumoweld not only gives you the money-saving benefits of low initial cost, but it eliminates maintenance costs for the life of your lines.

Supplies of Alumoweld Strand are available for prompt shipment from our warehouses in New York, Chicago, Pittsburgh and Memphis.

For the complete story on Alumoweld, write for Engineering Bulletin E. D. 3000.

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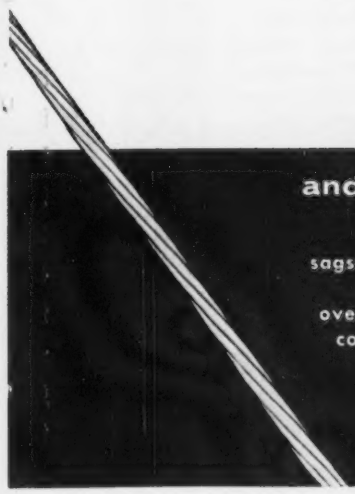
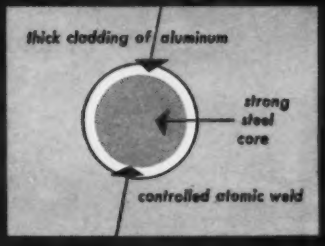
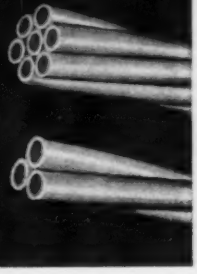


and FOR OVERHEAD GROUND WIRES

You can string with smaller sags to increase mid-span clearance when you use Alumoweld for overhead ground wire. Its excellent conductivity—3 times as much as steel—is helpful in reducing service interruptions by quickly discharging transient currents to ground.





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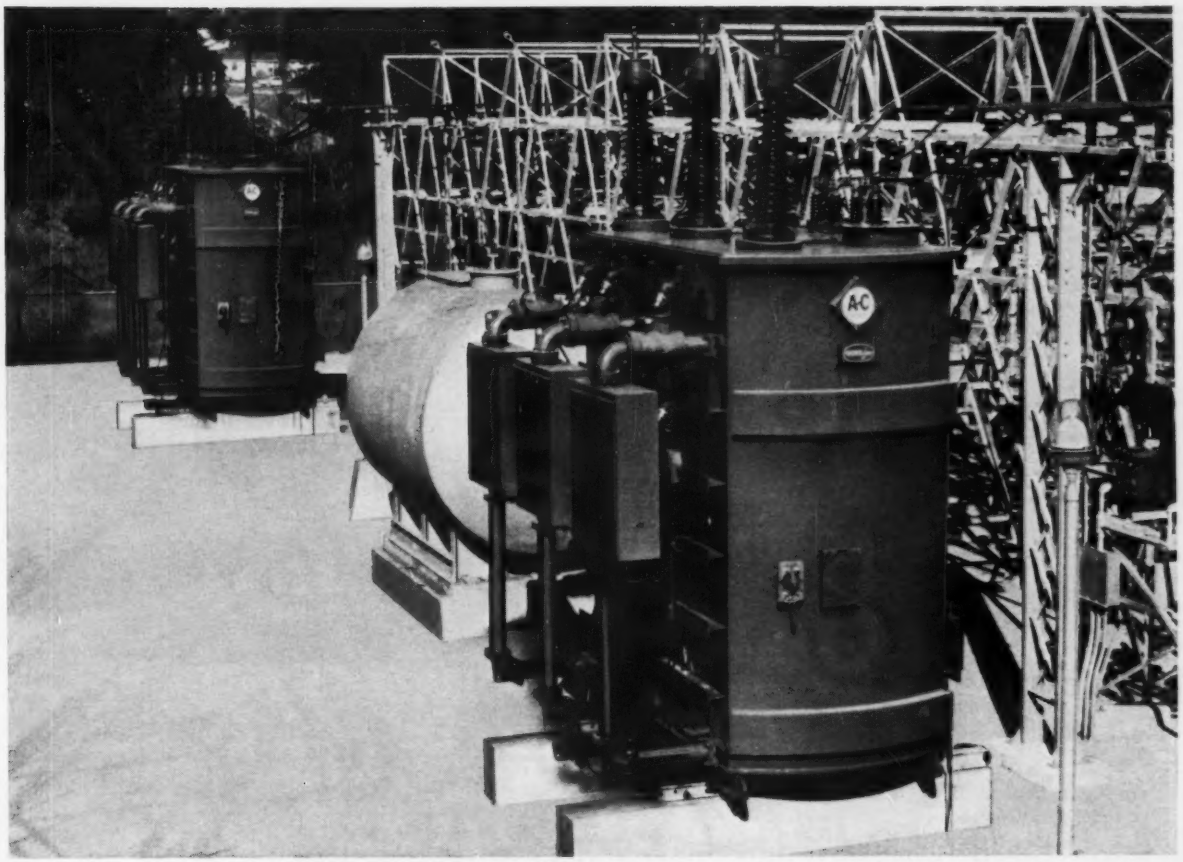
A-1461



Gulf Power Company's Bayou Chico Substation, Pensacola, Florida, uses 20,000-kva DUAL-COOLED transformers.

33% greater capacity

Dual-Cooling uprates either of two 20,000-kva transformers to 26,667 kva

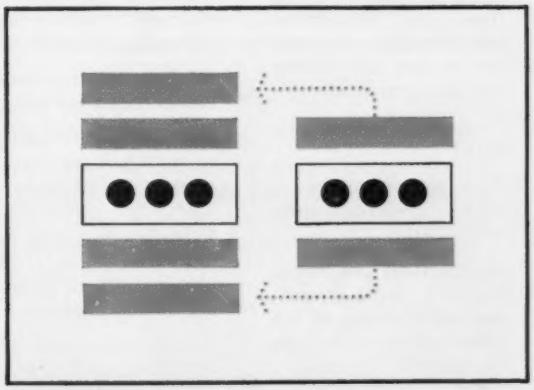
Now *Dual-Cooled* transformers offer both central stations and substations new opportunity to purchase *more* transformer capacity for *less money!*

With A-C dual-cooling, either of two 20,000-kva transformers, for example, can continuously carry 26,667 kva without loss of life.

Here's how it's done. In the event one transformer is off the line during an emergency, coolers from both units are connected to the functioning transformer. Emergency capacity of either *Dual-Cooled* transformer is increased one-third over its normal rating.

Dual-Cooled transformers are offered in any rating from 20,000 kva up. Contact your nearby A-C office for *Dual-Cooled* transformer application facts or write **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wisconsin.

Dual-Cooled is an Allis-Chalmers trademark.



In dual-cooling, a transfer of coolers from one transformer to the other uprates the active transformer capacity 33%.

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Extended Foil Capacitors

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4800-kvar Allis-Chalmers capacitor enclosure with provision for future expansion to 6000 kvar.

Install an Allis-Chalmers CAPACITOR ENCLOSURE where

appearance and dependability count

Allis-Chalmers enclosures are complete:

- Shipped assembled with 50 kvar capacitors, fuses, controls, current and potential transformers, switch and incoming line termination.
- Capacitors individually fused.
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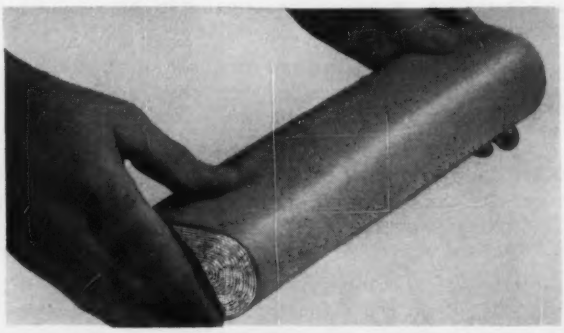
- Mechanical interlocks insure a closed grounding and shorting switch before cubicle doors can be opened.
- Dead-front control compartment isolates the circuit breaker and grounding switch.
- Vacuum switch or circuit breakers can be supplied.
- Roof entrance bushings or pothead for underground cable is available.
- Viewing window in rear of entrance cubicle for visual check of grounding switch position.
- Outdoor metal enclosure with three coats of paint.

Specify **Allis-Chalmers** *extended foil capacitors! Call, wire or write your nearby A-C office.*

Capacitor enclosed equipment available for 2400 through 13,800-volt, three-phase service, up to 6000 kvar. Allis-Chalmers also offers outdoor stack-racks and pole-mounted racks as well as current and voltage sensitive controls.



Allis-Chalmers extended foil design capacitors withstand higher inrush currents. Current densities are lower at point of contact between the packs and the contact plates than is possible with conventional tab-type capacitor construction.

Editorial Comment

APRIL 24, 1961

Hanford Power Would Set Appalling Precedent

It is becoming rapidly apparent that the Kennedy Administration is poised to mount an urgent, all-out effort to authorize conversion of the Hanford New Production Reactor (NPR) for generation of some 700 electrical Mw. This would be the first large block of federal thermal power outside the Tennessee Valley. It would create a precedent with implications no one should miss.

It is vital that this early attempt by government planners to break the barriers restricting federal steam to the TVA area be defeated decisively.

A welter of feasibility studies made since 1958 fill a 390-page report (EW, April 10, p 36) recently off the government presses. It is on the basis of the most recent studies that the Administration is asking authorization. But we submit that the studies raise almost as many questions as they seek to answer, both as to economic and political feasibility. Among the questions raised:

1. Are the justifications used intended to set precedents for allocating power costs on other multipurpose projects? If so, the way is cleared for a Trimble Bill which would limit power cost allocations to something less than an incremental basis. Indeed, if the recommendations of the NPR were paralleled on a hydro project, the power cost allocations would not even include the full cost of penstocks.

2. Are the NPR power facilities to be built to justify feasibility of the proposed California-Bonneville transmission intertie, or vice versa? You can get either answer from the sort of leap-frog logic evident in the report.

3. Are the NPR power facilities proposed to avert a power shortage in the Pacific Northwest or to create a deliberate surplus? In one letter, Interior Secretary Stewart Udall says NPR is needed to prevent a possible "power brown-out" (remember the phrase?) in 1964-'65, while simultaneously affirming increased marketability of NPR power if "regional interties" are built. In a later letter, he says that NPR conversion "would make some type of intertie almost essential."

4. What are the rates Atomic Energy Commission would charge Bonneville Power Administration for the power? If they are truly realistic, will they increase or decrease Bonneville's present deficit? Answers here are clouded by many assumptions hidden conveniently behind the cloak of military secrecy.

5. What happened to basic AEC nuclear power development policy asserting that reactors should be built to advance technology—not to get power output? This reactor which would supply steam to turbine throttles at 120 psig, saturated, in the dual-purpose period, is several steps backward in technology.

6. Is the $25 million already "sunk" in convertibility features sufficient justification for spending another $95 million for conversion? If so, why is no provision made for its recovery through power revenues?

7. Will NPR energy be marketed under the BPA preference clause? To get the original $25 million for convertibility, then-Chairman Clinton Anderson (D-N. M.) of the Joint Congressional Committee on Atomic Energy pledged no preference sales from NPR. But Anderson no longer heads the Committee.

The Administration's sense of urgency is seen by a schedule which shows turbines must be ordered by Oct., 1961, to get power production by Oct., 1964, the earliest possible time the reactor could provide firm heat for power. By coincidence, this is the date of the possible "brownout."

The Administration must not be allowed to railroad the NPR powerplant into place. There is plenty of ammunition available to defeat the precedent-setting proposal decisively. It must be used quickly and with accuracy.

- Separation of electric and natural gas cases asked
- FPC members are not in agreement with President's plan
- Tighter Presidential control of agency stirs objections

Kennedy Asks for Enlarged FPC

President Kennedy has asked Congress to increase the number of Federal Power Commissioners from five to seven, with the idea that a separate panel of commissioners would handle electric cases.

In a special message to Congress on regulatory agencies, Kennedy singled out FPC for particular treatment. Although most of his recommendations were directed to the Commission's work on natural gas, some of the proposals will also affect the electrical industry's position.

Kennedy urged the addition of two members because of FPC's broad position of jurisdiction over electric power projects and gas production and transmission.

"The techniques necessary for the handling of problems in the fields of electric power and natural gas are different," he said. "An understanding of one industry does not guarantee a background for dealing with the other."

He said the "chaos and delay" now characterizing the gas regulation field "may soon increase in the electric power area." He forecast that in coming years the problems surrounding the future of hydroelectric generation will "call for reappraisal and hence for added attention."

Smaller Panels May Make Decisions

The White House message said that, with the addition of two more members to FPC, the Commission will have clear discretion to allocate decision-making to smaller panels.

"For example," Kennedy said, "the chairman could establish three panels of two other members and himself, two working with gas and one with electricity." An alternative given was for two three-member panels, freeing the chairman for administrative work.

Another proposal was that single commissioners could handle lesser matters coming before FPC, with decisions subject to the entire Commission's review.

The proposed increase in FPC membership stirred speculation in the electric power industry that, if Congress authorizes new members, Kennedy might nominate as commissioners men more compatible with investor-owned power views as a balance to the two recent Administration nominees, Joseph C. Swidler and Howard Morgan of Oregon.

The plan also recalled a line of questioning by Sen Hugh Scott (R-Pa.) at Senate hearings on the Swidler nomination. Scott asked Swidler if the Administration planned to seek additional FPC members to offset Swidler's voting. Swidler avoided any direct answer.

FPC officials, however, are not enthused at Kennedy's idea of a panel of commissioners for electric cases. They concede that some division of responsibility might expedite gas matters, but do not think the work load justifies a panel for electric cases.

President Would Pick Chairman

Kennedy also wants to make the FPC chairman serve at the discretion of the President, rather than for his term of appointment as now practiced. Kennedy has indicated he wants to name Swidler as FPC chairman to succeed Jerome Kuykendall, but so far Kuykendall has held onto the job he was given by President Eisenhower.

In his general recommendations applicable to all regulatory agencies, Kennedy pointed to a general tightening and fixing of responsibility. Each chairman would be accountable to the President for operation of his agency—a plan designed to avoid dilution of authority among a number of commissioners.

Missing from the regulatory message were several key points urged by the President's top regulatory advisor, James M. Landis. One Landis recommendation which was dropped called for establishment of a permanent administration overseer for all agencies.

Also dropped was Landis' idea that policies of various agencies concerned with energy should have White House-directed coordination. Legislation aimed at the general area of policy making is in the Congressional hopper (see next page) and is drawing varied reactions among administrators and lawmakers. Some of the Presidential ideas are meeting opposition, even from Democrats.

British Engineers Propose Concrete Reactor Vessel

Proposed arrangement in which the entire gas coolant circuit—core to steam generators—is enveloped in a single reinforced concrete vessel may become a significant advance in the gas-cooled, graphite-moderated reactor system favored in Great Britain. British consortia are making this proposal to cut capital cost, modify the reactor safety picture and improve the thermal characteristics of the system.

The design calls for a concrete cylindrical pressure vessel held in compression by an array of steel cables around the outside. It will probably be lined inside with a relatively unstressed steel membrane, which would make the envelope gas-tight and keep the gas clean. Tension on the cables could be varied and cables replaced without reactor shutdown.

The compact design is not only expected to cut cost but overcomes the suspected problem of long-term steel-vessel embrittlement from radiation. Above 400 psi, however, the steel vessel still seems better. The advantages of the concrete envelope design do not appear to apply to liquid-cooled systems favored in the United States and Canada.

Plans for Advisory Council Differ

Push and pull between the Administration and Congress develops on subject of advisory council on resources

Proponents of legislation to create White House advisory council on natural resources ran headlong into each other and the President, when they tried to hold a hearing last week on how the job should be done.

The three principle plans are:

(1) Legislation (S-239) by Sen Clair Engle (D-Calif.) and 30 other Senators, to create an independent, three-man resource advisory council in the White House, and a joint Senate-House resource committee.

(2) Legislation (S-1415) by Sens Gale McGee and Joe Hickey (both Wyoming Democrats), to create only the White House council, leaving out the joint committee simply because it would stir up long-standing Congressional opposition to joint committees—particularly by House Speaker Sam Rayburn (D-Tex.).

(3) The Kennedy Administration plans, still in the formative stage, which would call for White House resource coordination within the present framework of the Budget Bureau and the Council of Economic Advisors. Again, no joint Congressional committee would be requested.

The controversy came out in a hearing by the Senate Interior Committee, called to consider the Engle and McGee bills.

The controversy between the two bills—over addition of a joint resources committee—seemed to be more one of mechanics: What would be the best way of getting it done?

Departments Want Delay

The Interior and Agriculture Departments and the Budget Bureau have asked the committee to delay any action on the bills until the President can "follow through" on his recent natural resources report. In that report, the President had indicated his intention to create a natural resources advisory group within the present Council of Economic Advisors.

Agriculture Secretary Orville Freeman said, in his report to the committee, that the present White House set-up should be able to carry out the activities that the Senate committee had in mind and Freeman added that the Engle plan of annual reports on natural resources would be too often and too costly.

Interior Undersecretary James Carr urged the committee to postpone action on any legislation until next January, giving the President time to "re-define responsibilities" in the Executive Department.

Sen McGee pointed out that, "In the last day or so, most of us have had communications from the White House suggesting that it is the judgment of the Administration that they don't need a body like this at the White House level. They can take care of it through the Bureau of the Budget. They can take care of it now through the Council of Economic Advisors . . . I seriously question this."

Sponsors of Bills Object

Both Engle and McGee took issue with the Administration's stand, quoting various campaign statements by Kennedy to the effect that he had been agreeable to creation of an independent White House council. Engle also refuted the objections of the Agriculture and Interior Departments on the grounds that, "I have never seen a government department that wants to be coordinated."

They suggested indirectly that the Administration had backed away from its commitments on resources. Engle said he didn't intend to wait until next January to act on his bill. Sens Philip Hart (D-Mich.) and Jennings Randolph (D-W.Va.) backed Engle on his bill.

Sen Lee Metcalf (D-Mont.) also questioned the Administration's plans for coordinating resource activities in the Budget Bureau. Metcalf, however, said he opposed creation of a joint Senate-House resources committee. He wants just the independent White House body. Committee Chairman Clinton Anderson (D-N.M.) agreed with Metcalf, supporting the McGee-Hickey bill in preference to Engle's bill.

Sens Thomas Kuchel (R-Calif.) and Gordon Allott (R-Colo.) opposed any new resources body. Kuchel sided with the Administration against the committee Democrats in recommending a year's delay.

Davidson Speaks for Engle Bill

C. Girard Davidson, former Assistant Interior Secretary and chairman of the Democratic party's Advisory Council on resources, told the committee that Engle's bill was necessary.

"While I was Assistant Interior Secretary, it was well nigh impossible to consider a resource program in its entirety, objectively, with broad perspective and imagination." He said the Engle bill would direct the various departmental secretaries to work with other departments, and it would suggest "planning commissions for all major river basins.

"I'm afraid President Kennedy is trying to achieve his goals by means that have failed previously," he pointed out.

An interesting sidelight to the hearing followed a recommendation by General Manager Alex Radin of the American Public Power Assn, that the proposed resources council make a "national inventory of hydro potential"—a recommendation first made by Resources For The Future, Inc.

Anderson told Radin that the committee was "planning a little work on that . . . it just could be that some sort of study of these hydroelectric possibilities will be undertaken by this committee . . ."

Budget Bureau May Be Called

Anderson adjourned the hearing. Next step may be either President Kennedy's announcement of his natural resources advisory group, or another hearing by the committee—possibly to hear what the Budget Bureau has to say about resources planning.

Senate Probes Antitrust Cases

Testimony before Senate subcommittee reveals meetings between manufacturers were frequently unsuccessful, angry

A picture of disjointed, sometimes angry, often unsuccessful meetings between competitors in the electrical equipment industry was presented to the Senate Antitrust & Monopoly Subcommittee by executives who took part in them.

Witnesses, from General Electric Co, Westinghouse Electric Corp, Ingersoll-Rand Co and Elliott Co Division of Carrier Corp, readily acknowledged they had participated in meetings with competitors at which prices and contract allocations were discussed. But they generally agreed the sessions were not too effective; and they often broke up angrily with no agreement.

Hearings before Sen Estes Kefauver's (D-Tenn.) subcommittee got underway last week after two days of bickering between Democratic and Republican committee members over whether the hearings should be held at all; and if so, whether they should be in closed sessions, as Sen Alexander Wiley (R-Wis.) maintained. Republicans were unsuccessful.

Inquiry Is for the Record

Kefauver called the hearings to put more information about the government's charges of price-fixing in the electrical industry on the public record and, ostensibly, to inquire whether amendments to the antitrust laws are needed. Indicted by the government were 29 companies and some of their officials. They all pleaded guilty or no defense to the Sherman Act charges and were fined a total of nearly $2 million. Seven officials also were sent to jail for 30 days and other suspended prison sentences were handed down.

"What was the purpose of the meetings?" Kefauver asked John Peters, a marketing research specialist in GE's large steam turbine generator department. "I have asked myself that question, sir, many times in the last two years," Peters replied. "Occasionally," Peters said, discussion would center on which of the three companies making large turbines—GE, Westinghouse and Allis-Chalmers—would put in low bids on specific jobs. At other meetings there was no talk of bidding on specific jobs or prices.

Price Not Always Criterion

And, said Peters, there was an understanding that companies other than the agreed-upon low bidder would go after contracts on a basis other than price such as efficiency ratings of turbines, service facilities, or different machine designs. Many times, said Peters, GE would get a job even though it was not the agreed-upon low bidder. In 1958, for example, he said, "our principle competitor (Westinghouse) didn't get an order to the best of my knowledge."

Large turbine makers held from four to six meetings a year, one in the fall in conjunction with an American Society of Mechanical Engineers meeting; one in spring incidental to an annual meeting of the American Power Conference, and the others called at the request of a company when found "advisable."

Peters said he would write down, for his own information, figures pertaining to what GE planned to bid on a specific contract that was to be discussed at one of the meetings, but "once I made a quotation I destroyed the paper."

"Occasionally," Peters said, discussions were held by telephone. "I never called from my office," he said, "usually from a pay station, and I called them at their homes."

Other Meetings Admitted

A similar picture about meetings between competitors in other phases of the industry—small and medium turbines, and condensers—was presented to Senators.

B. R. Sellers, manager of turbine generator sales for the Elliott Div of Carrier Corp, said he recalled meetings between small turbine competitors for 15 years until they ceased in mid-1959. Witnesses agreed the meetings stopped in "early 1959" or "mid-1959."

Donald Ray Jenkins, sales manager of medium turbines for the Westinghouse steam division, said he had never discussed price increases at meetings with competitors, but said, "I have attended meetings where agreements were made that particular manufacturers would be low bidder." Jenkins continued, "There was always the understanding that whomever could get the job would get it; and believe me we all tried."

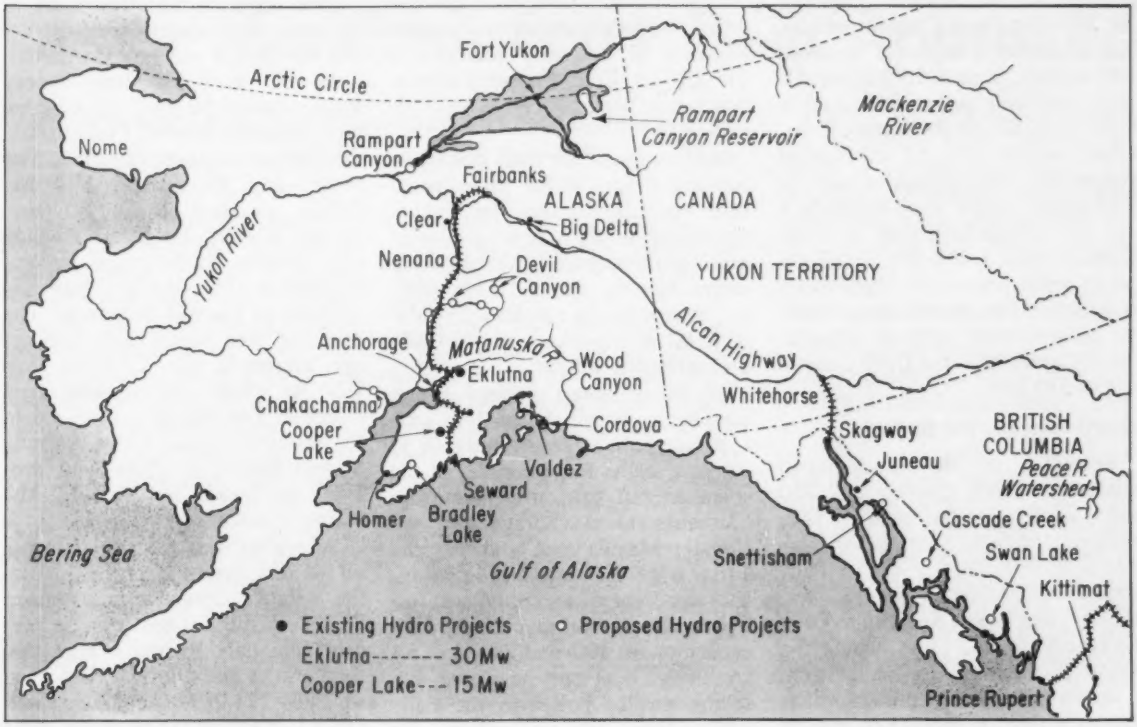
"What turn would the discussions take?" Kefauver asked Jenkins. "Would a man say, 'I haven't had a contract in some time and I feel I should get this one.'?"

"You sound like you'd been there, Senator," Jenkins replied. Meetings of medium turbine-makers were also held in conjunction with industry-wide sessions, Jenkins said, such as the National Electrical Manufacturers Assn, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Power Conference. They usually lasted 15 minutes to an hour, and "Usually broke up in discord, occasionally with the understanding that one manufacturer would be low bidder."

Lower Prices Resulted

R. J. Bunch, currently manager of centrifugal pump division, but former manager of condenser and ejector division, said meetings of condenser makers were held in an effort to "establish a level of prices that probably would have been something less than the published prices . . ."

Another Westinghouse witness, Alva A. Johnson, manager of the assembled switchgear and devices department, said he was told in 1957 by his superior, Landon Fuller, that meetings with competitors were taking place. "But in effect he told me I should have no part of them," Johnson said. "You just let them go on?" Kefauver asked. "I've already said Fuller was handling the meetings and I had nothing to do with them," Johnson said. "I was in no position. I was caught in the middle."



Giant Alaska Hydro Plan Pressed

President's budget request for further studies brings Rampart Canyon Dam a step closer to realization

What may eventually be the largest hydro power plant in the free world got another push toward realization last month when President Kennedy's new budget request tripled the $100,000 Eisenhower had requested for further studies on Alaska's Rampart Canyon Dam. Straddling the Arctic Circle some 100 miles north of Fairbanks, the big Yukon River project is reported to have an ultimate potential of 4,760 Mw and a cost to match it—about $1 billion. Studies for the project alone will cost an estimated $900,000, according to the Corps of Engineers.

Coming on top of another 700 Mw of hydro projects that Alaskans are asking for immediate government action on, the Rampart project exemplifies the new state's optimism. When completed, the Rampart project would impound some 1.3 million acre-ft in a reservoir of 10,700 sq miles—10% bigger than Lake Erie—behind a 500-ft gravity dam. Measuring 1,400 ft at the base and about 3,000 ft at its crest, the concrete dam would provide a usable power head of about 440 ft on a river that ranks in the same league as the Mississippi-Missouri and the McKenzie-Peace.

About $49,000 of the estimated $900,000-study cost was spent in the previous fiscal year and another $225,000 is now being spent. This, with the $300,000 Kennedy has requested, would leave about $325,000 to be appropriated in fiscal 1963. And Alaskans are pushing hard for fast action on the project.

Actually, Rampart Canyon is intended primarily as a long-range source of power that could not be completed before 1970. According to testimony by Floyd Dominy, Commissioner of Reclamation under Eisenhower and now Under Secretary of the Interior, the project could produce 2-mill power at the bus bar, and with a 115-230-kv transmission line from Rampart to the sea, 3-mill power at coastal sites. On this 3-mill prospect, Alaskans are building visions of huge electrochemical industries—aluminum and others—to replace the state's heavy dependence on the military and support an expected surge of population.

It is for shorter-range needs, to meet a power shortage anticipated in 1965, that the other 700 Mw of new projects are being requested. Included is the 48-Mw Crater-Long Lakes diversion scheme, about 28 miles south of Juneau in the Alaskan panhandle. The Bureau of Reclamation has just restated its position in favor of this $40-million diversion, part of the Snettisham project, and estimated a benefit-cost ratio of 1.67-1. The project would require about 38 miles of 115-kv transmission to deliver power to Juneau and could produce 6.1-mill firm power with a 50-year payout, the Bureau says.

The Bureau of Reclamation has recently issued a new report on

another of the "interim" projects, the 580-Mw Devil Canyon scheme. The estimated cost would be about $99 million, with a 1.72-1 benefit-cost ratio and power selling at 6 mills. Located on the Susnita River, which empties into the sea west of Anchorage, the project would be built in two stages. First would be a 635-ft concrete arch dam at Devil Canyon, with a 218-Mw initial capacity seven years after construction is started. The second stage would be an upstream reservoir dam to boost capability at the Devil Canyon site to 580 Mw.

Devil Canyon 'No Bargain'

Included in the Reclamation study for Devil Canyon are 350 miles of 230-kv transmission line, running 160 miles south to Anchorage and 190 miles north to Fairbanks. According to Dominy's testimony, cost of the Anchorage-Devil Canyon-Fairbanks line would be about $70 million. By comparison, a study by a local consultant has shown a cost of about $13 million for a 327-mile, H-frame, wood-pole, 115-kv, 20-Mw line convertible to 230 kv and including three intermediate substations plus a 20-Mva terminal substation at Fairbanks.

Although the Devil Canyon site is located between Fairbanks and Anchorage and along the rail belt where most of the state's slim population lives, not all Alaskans are enthusiastic about it. Sen Ernest Gruening (D-Alaska), who toured the state as a one-man Senate Subcommittee last year to develop an estimate of the new state's needs and resources, reported to Congress that, "It is apparent that Devil Canyon, in comparison to Rampart Dam, would be no bargain to the taxpayers of the U.S." Gruening pointed out that although Rampart would cost twice as much as Devil Canyon, it would produce ten times as much power.

A third "interim" project, this one favored by Gruening, is the 64-Mw Bradley project near Homer on the Kenai peninsula. This 64-Mw Corps of Engineers water diversion project would cost an estimated $42 million. Actually, Bradley Lake would require very little new transmission construction. The site is close to an existing 61-mile, 69-kv line running from Homer to the 15-Mw Cooper Lake project recently completed by Chugach Electric Assn, a rural cooperative. And Chugach is currently planning a 115-kv line from Cooper Lake to Anchorage area, where most of its load is.

Still another "interim" site is the Nenana River, which flows north near the railroad into the Yukon. According to the Corps of Engineers, the river could be developed in stages, starting with a 16-Mw project and eventually reaching 237 Mw of installed capacity, with 150 Mw of continuous output.

If the Rampart project comes into being, it will be in line with a strong public power tradition in the new state. For example, in the so-called rail belt, stretching from Fairbanks to Anchorage and the Kenai peninsula and holding some 140,000 of the state's 224,094 inhabitants, there are only two investor-owned electric utilities, with capacities of 400 and 600 kw respectively, plus one new company selling surplus power in the Fairbanks area. By comparison, the Bureau of Reclamation hydro project at Eklutna has a capacity of 30 Mw which is sold to the city of Anchorage and two rural electric cooperatives.

Public Ownership Predominant

Other rural co-op and municipal generation in the Anchorage-Kenai area totals about 40 Mw, while generation at military posts is almost 56 Mw. Similarly, in the Fairbanks area, all but a small fraction of the generation is owned by either the city of Fairbanks, rural co-ops, or military bases. And though investor-owned power is stronger in the panhandle, where the state capital of Juneau is located, almost all the steam generation and 90% of the hydro in the state is publicly owned.

Because of the small loads involved and the vast distances, transmission is a major problem in Alaska. Although presidential candidate Kennedy spoke of "a giant electric grid stretching from Juneau to Anchorage and beyond," during a campaign speech in Anchorage last year, these two major cities are some 571 airlines miles apart. By road, if there were one, or by transmission line, the distance would be well over 800 miles.

One major buttress for some of the proposed transmission construction is based on military needs. Thus the Technical Inter-Agency Power Group Report, representing the Federal Power Commission, the Departments of Interior, Defense, and Commerce, and the Offices of Business and Defense Service Mobilization and of Civilian and Defense Mobilization, recommended in 1959 that a 115-kv line be built in the rail belt area. The proposed line would link Anchorage, Fairbanks and Big Delta, provide an outlet for possible coal plants in the Nonanna area, tie in the Ballistic Missile Early Warning System station at Clear, and provide an outlet for the 1.7-Mw atomic reactor at Ft Greely.

Where do Alaskans expect to use all of this potential power? True, the state's population jumped 74.2% in the last ten years, a percent gain only slightly behind that for Nevada and Florida. But even so, its 224,089 population still ranks last among the 50 states. And while a possible power shortage in the near future is conceded by most authorities, energy needs for normal uses are estimated at only 838,000 Mwhr by 1970 or 1,480,000 Mwhr by 1980.

The main incentive behind the drive for more power is to lower existing power rates, now among the highest in the country. Thus typical residential monthly bills for 100 kwhr range from $4 in Ketchikan, with a 5,801-kwhr average to $3.25 in Fairbanks, with an average annual use of 2,800 kwhr.

Seek Industrial Load

But the major objective is to bring in new large industries by assuring them large blocks of power at low rates. Thus one consultant for the local utilities foresees Alaska supplying 18 million kw for aluminum industry alone by 1985. The Kenai peninsula also is the site of one of the best deposits of chromite in the US, while large phosphate deposits, normally refined in electric furnaces, have been reported in northern Alaska. In the panhandle area, load growth is predicted on use of 30 and 40-Mw chunks of power by pulping mills and also for refining the large deposits of magnetite in the Snettisham area.

Larger Markham Ferry Dam Approved

Federal Power Commission also approves rate agreement between Public Service of Oklahoma and Grand River agency

The Federal Power Commission recently approved an increase in the generating capacity of Grand River Dam Authority's licensed (but unbuilt) Markham Ferry hydroelectric project, Okla. The Commission also approved a 1958 rate schedule between the Authority and Public Service of Oklahoma.

But the Commission turned down a proposed long-term coordinating agreement between GRDA and Public Service, relating to operations between the two systems after Markham Ferry is on line.

The FPC's order is similar to that recommended nearly a year ago by Presiding Examiner William J. Costello.

The increased capacity for Markham Ferry gives it a total of 100 Mw (four 25-Mw units), contrasted to its original size of 45 Mw—approved when the project first was licensed in 1955. Cost of the enlarged project is estimated at $27.4 million.

Both GRDA and Public Service had argued for all three points in the consolidated license-rate case: **(1)** capacity increase, **(2)** 1958 rate schedule, **(3)** long-term coordinating agreement.

Cooperative Intervenes

Kamo Electric Cooperative, Vinita, Okla., had intervened in the case, opposing both the 1958 rate schedule and the coordinating agreement. Kamo Attorney Lambert McAllister said the schedules would force GRDA to operate at an $500,000 annual loss, and preference customers—including Kamo—would have to make up this loss. Local Kamo Attorney Jack Roschach called the schedules "a vicious arrangement," giving Public Service unfair advantage over GRDA.

Public Service Attorney Randall LeBoeuf said the rates were fair, adding, "The fundamental issue that is life and death to the Markham Ferry project is that the company would furnish back-up energy" to the Authority to build and operate its project more economically.

FPC Staff Attorney Drexel Journey also favored the 1958 rate schedule.

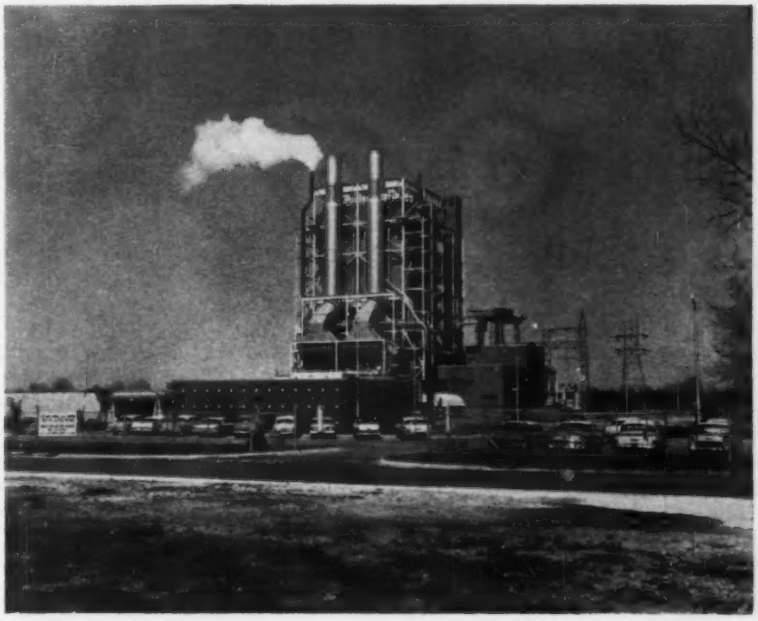
Journey, however, along with Costello and the full Commission, disagreed with GRDA and Public Service over the legality of the long-term coordinating agreement until Markham Ferry actually comes on line. They said it couldn't even be accepted for consideration by the Commission.

The Commission differed slightly with Costello on whether the long-term agreement could win "interim approval" or a "presumption of lawfulness" by means of an amendment to the license.

GRDA is a state-owned authority, operating steam and hydro plants in eastern Oklahoma. The proposed Markham Ferry dam would back water up to the tailwater of Pensacola Dam, on the Grand River.

Kamo Attacked Examiner

The heated contest reached its peak last August, when the Commission rejected McAllister's legal brief of "exceptions to the initial decision" (of Costello) in the case. The FPC called McAllister's brief "defamatory, scurrilous, unethical," and dealing with "the personal character, motives and integrity of the presiding examiner, rather than being confined to a discussion of the issues . . . " McAllister subsequently re-submitted his brief, acceptable to the FPC.



Little Gypsy Begins Commercial Output

Little Gypsy, the world's first generating station designed specifically for automatic operation, recently began commercial production of electricity.

Owned by Louisiana Power & Light Co, the 220-Mw single-unit station is initially operated by manual control. Computer facilities are installed, but several months will elapse before the first trial of automation techniques.

Cable Men Study EHV Field Tests

Cornell EHV Cable Conference draws authorities from 14 nations to consider trends in developing and testing of high voltage cable—see start of testing at Cornell

Which is better for proving the capability of new-type EHV cable systems and gathering information for successful application: The field testing station or the controlled environment found in a cable laboratory?

This question was argued up and down the corridors as well as from on the rostrum of the special AIEE Extra High Voltage Conference at Elmira, N.Y., April 11-13 by the elite of the world's cable authorities.

Opinion was sharply divided and independent of nationality. Cable users from Europe and the US held strongly to the view that field tests, such as those conducted at the Cornell EHV Cable Test station, are necessary for evaluating system performance of EHV cable properly under actual conditions of weather and other circumstances encountered in service. Cable makers, on the other hand, held that the cable lab, where variables affecting cable performance can be carefully controlled, yields the most accurate comparison of different cable types.

Attracts Foreign Cable Experts

The close timing of the Elmira EHV Cable Conference with the meeting of the CIGRE High Voltage Cable Committee No. 2 at Detroit the previous week and the start of testing at the Cornell Test Station on April 4 combined to attract to Elmira overseas cable authorities who gave the discussions an international flavor.

Prof J. C. van Staversen, director of KEMA Laboratories of the Netherlands, combining both a utility and a research viewpoint, urged careful coordination of both field and laboratory tests of EHV cable systems.

"You can't start a new type of cable for EHV that has only been studied in the laboratory without having done stability tests under field conditions as is now being done at Cornell," he said. "But there is a big difference between laboratory tests in the laboratory and laboratory tests in the field . . . Look after the influences in the laboratory type tests and then test in the field, but keep the variables as separate as possible," he said.

Roger A. Tellier, cable research engineer of Electricite' de France, associated with the Fontenay cable test station, also attached importance to field tests. At Fontenay, practice has been to energize test cables directly from the French 225-kv system using phase-to-ground or phase-to-phase voltages, he said. While acknowledging the imperfections of this arrangement, Tellier said that he considered field tests an important complement to type testing in the maker's laboratory.

"It is important to learn to handle and install EHV cables properly and how they behave under field conditions," he said.

C. C. Barnes, cable engineer, Staythorpe cable field test station of the Central Electricity Generating Board, England, said he was "all in favor" of people who want both laboratory and field tests.

"I don't think any user will take expensive cable on the basis of tests by white-coated workers in the laboratory without such field tests," he said. At Staythorpe, as at Fontenay, Barnes said, test voltages were taken directly from 275-kv grid lines.

But not all the comment on field testing was favorable. C. T. W. Sutton, Enfield Standard Cable Co, England, warned the Cornell researchers to decide now what they are trying to prove. Is it a question of cable loading, he asked, or of competition? Observing that "staggering amounts of money" have been spent, he warned that more will be needed.

C. T. Hatcher, Consolidated Edison, replied to Sutton that the Cornell tests are not designed to prove that US-built cable can operate successfully at 345 kv.

"That has been proved. We are trying to determine whether 345-kv cable can maintain stable losses when fully loaded and carrying commercial load cycles. In other words, we are conducting stability tests. The Cornell field tests are not competitive," Hatcher said. "We are seeking information. Loading cycles will be identical for all four cables."

Dr A. N. Armen, Pirelli General Cable, England, said that the field test conditions, particularly at Fontenay, were "too vague" to be helpful. To this Tellier retorted: "Isn't this exactly what field tests will prove that cables can stand in service?" Palmieri, of Pirelli-Milan, observed that the Cornell test program makes no provision for reproducing conditions that result when load is switched. He predicted that oil pressure gradient would reach a maximum when load is disconnected after having been on for 15-30 min.

Prefers Laboratory Tests

L. F. Hickernell, Anaconda Wire & Cable, said that some of the more inconclusive findings of field tests at Fontenay illustrate the difficulties of attempting to evaluate different cable designs and systems with so-called field tests that use existing systems as a source of voltage.

"For differentiating between designs and materials used in a cable, *per se*, or for a comparison between systems, we much prefer laboratory cyclic load tests under controlled condition," he said. "In evaluating a cable design, of what value is it to apply one terminal out-of-doors on a clear day and the other in the rain? In practice, terminals are applied under varying atmospheric conditions, but presumably this is after the cable design itself is proved adequately," Hickernell said.

Cable development at voltages up to 500 kv was reported to be in progress in several countries having overhead transmission systems in this voltage range. In England, where grid voltage is to be raised to 400 kv, Barnes disclosed that CEGB is considering building a 400-kv cable testing station.

P. M. Hollingsworth said that BICC has design underway on a 400-kv cable. In Russia, where a 500-kv overhead system has been in

at Cornell

operation for upwards of a year, Dr D. V. Bikov, Scientific Research Institute of the Cable Industry, Moscow, said that a 500-kv HPOF pipe cable system 1¼ miles long has been built and tested for 3,100 hr. He described the cable as having a voltage gradient of 15 kv per mm and a power factor of 0.25%. J. M. Oudin said that Cables de Lyon, France, has six cables on order for voltages from 380 to 500 kv presumably for eastern and western European 380 and 500-kv systems. The 500 kv is an oil-pressure self-contained design with a capability of 1,400 Mva, a working stress of 200 kv per cm.

Herman Halperin, Commonwealth Edison, said that in the US, work at Cornell and the manufacturers' further research would justify commercial underground installations of self-contained single-conductor oil-filled cable on 500-kv lines when needed. For 345-kv lines planned in the Chicago area and elsewhere, capabilities of 600 Mva and more will be needed. For such cases similar cable for 345-kv lines will become available.

Progress in the development of synthetic cable insulation was reported by both US and European cable men at Elmira. Van Staversen, among the pioneers in this field, attached importance to matching the dielectric constant of solid and liquid dielectrics in such designs to avoid distorting the electrostatic field at tape junctions, thus diminishing impulse strength. Tellier said that the French system has done considerable work on behavior of plastic cable under dc potential and is now undertaking long-time tests at 250-kv dc. Barnes conceded that plastic cable is attractive, but said its cost is up to twice that of paper and oil in England. He suggested that the possibilities of paper and oil haven't yet been fully exhausted. Hickernell disclosed that Anaconda has built and run cyclic load tests on a full-sized, 345-kv LPOF cable (EW, April 17, p 60). "We believe the replacement of paper with plastic tapes is entirely feasible. Although performance has far exceeded expectations, much development remains to be done to obtain a commercial product."

SPONSORS OF EHV CONFERENCE with L. I. Komives (left), Detroit Edison Co, are L. F. Hickernell, Anaconda Wire & Cable Co; R. J. Wiseman, Okonite Co; Joseph Stitcher, Detroit Edison, and C. T. Hatcher, Consolidated Edison Co

HEAVY OVERSEAS ATTENDANCE marked conference signaling start of tests at Cornell. Standing are C. S. Schifreen, Philadelphia Electric Co, and L. I. Komives, Detroit Edison Co, planners of cable test station

EHV CABLE SAMPLES of four types at Cornell test station captured the interest of delegates at the special AIEE cable conference at Elmira

Shield-Wire Conductivity Cuts

Norwegian 300-kv line depends on its ground wires to lessen telephone interference, earth potential gradients

HANS GAMMELSAETER, Section Head, Line Dept,
AAGE NORDBOE, Engineer, Operating Dept, A/S Haflund, Oslo, Norway

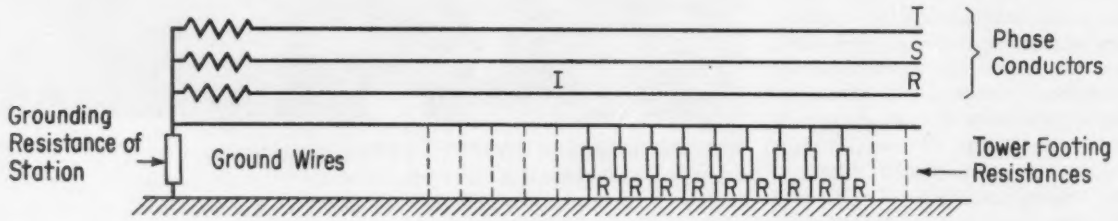
Inductive interference on communication circuits and potential gradients at tower footings and switching structures during phase-to-ground faults can be reduced by increasing the shield wire conductivity on transmission lines. The effectiveness of this method has been demonstrated by calculations and tests on a 15-mile section of the new Flesaker-Saaner line designed and built by A. S. Hafslund for the Norwegian Watercourse & Electricity Board.

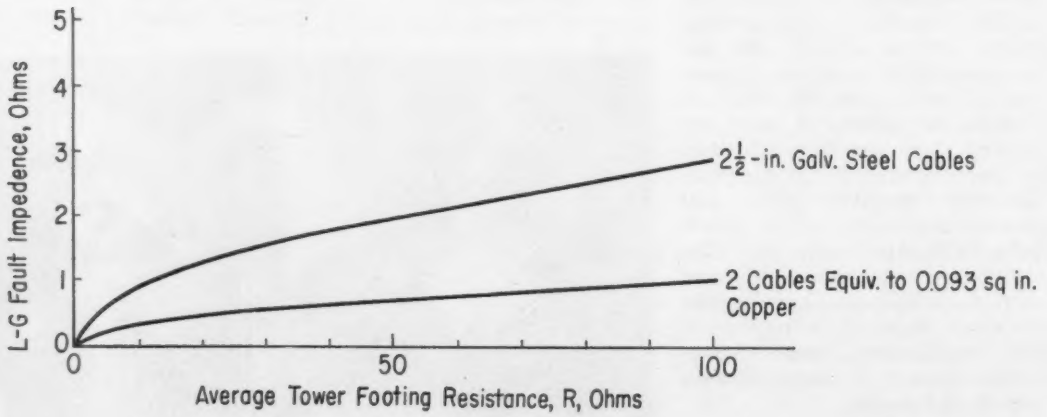
This line, to become part of an effectively-grounded 300-kv transmission system interconnecting large hydroelectric stations with Norway's existing transmission and distribution networks, has 34 miles of open wire on single-circuit structures and 1.25 miles of four single-conductor submarine cables across Oslo Fjord. Operation will be at 138 kv until the rest of the 300-kv system is ready for service.

The open-wire line traverses an area of low earth conductivity, the strata consisting largely of gneiss and granite covered by a relatively thin layer of good conductivity earth. Resistivity values in such areas, determined by measuring mutual impedances between line and earth returns, range from 10,000 to 2,500,000 cm-ohms. Analysis of fault conditions assumed for the proposed line, supported by induction measurements and geological examination of the soil along the line's route, led to selection of 250,000 cm-ohms as a mean value of earth resistivity for calculations of inductive interference with adjacent communication circuits.

Single-line-to-ground fault currents on the proposed 300-kv system were investigated, using a network analyzer. Available currents were found to reach 20,000 amp in the central portion of the system, tapering off to 2,000 amp in remote sections. Return currents from such faults were found to divide between the earth path and the overhead ground wires, the earth component inducing power frequency voltages in paralleling communication circuits.

Further analysis revealed that the two 0.5-in. galvanized steel ground wires originally ordered for the Flesaker-Saaner line would carry only a small portion of the total L-G fault current, forcing about 84% into the earth path. Adding a layer of 16 0.110-in. aluminum strands over the steel raised each wire's conductivity to about that of 0.093-sq-in. copper; with two such ground wires, almost 60% of the total fault current would flow through the ground wires leaving slightly over 40% for the earth path. The same distribution could have been achieved by substituting copper-covered or aluminum-covered steel





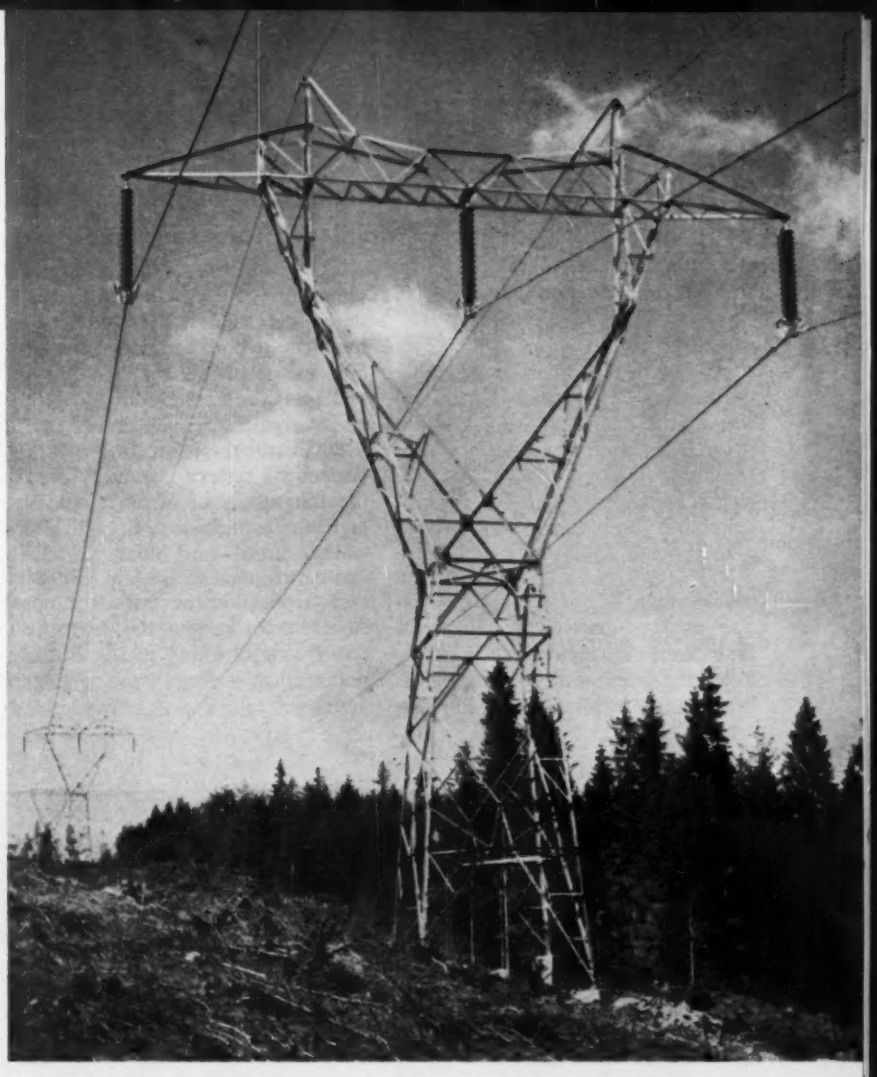
Fault Effects

cables having a conductivity equal to that of 0.093-sq-in. copper.

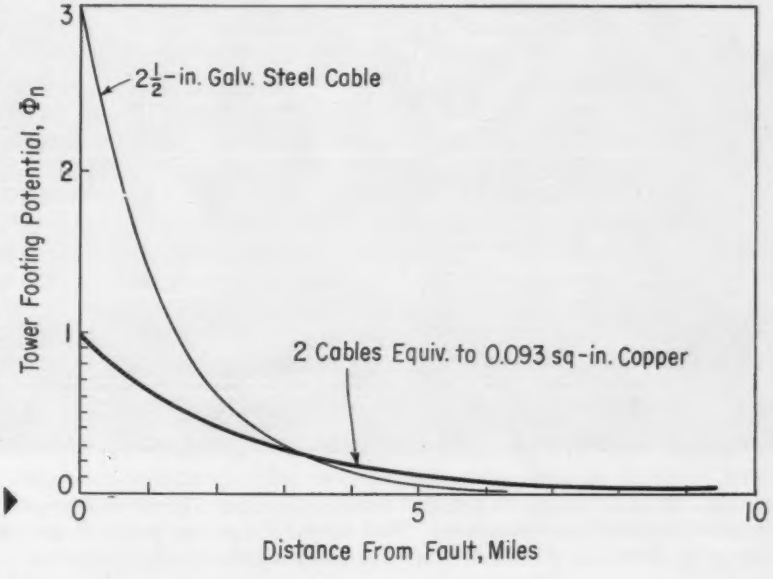
Boosting the ground-wire's conductivity reduces the line's zero-sequence impedance and permits a small increase in fault currents, estimated at up to 10%. But the earth return current will be only 50 to 60% of that for a circuit built with ordinary steel shield wires. And the power-frequency voltage induced in communication circuits is reduced correspondingly.

Potential gradients on the earth's surface near the fault are also reduced by increasing the conductivity of the overhead ground wires. In this case, adding the layer of aluminum strands to give the ½-in. steel cables a conductivity equivalent to 0.093 sq-in. copper cuts the over-all impedance to earth by about 70%. Thus, even though the total L-G fault current is slightly greater, the resulting potential gradient at the tower nearest the fault will be only 30-40% of the value which would have existed had the steel ground wires been used. Potential gradients will be reduced less at towers more remote from the fault and may even be increased at distant points. But gradients at such points are generally too low to be hazardous to people or animals and the over-all result is a distinct reduction of possible hazard.

Field tests on the first 15-mile section of the Flesaker-Saaner line confirmed the predicted distribution of fault current. The average earth resistivity of this section, computed from measured power-frequency voltage induced in communication circuits, is 100,000 cm-ohm. Later tests on the completed line again confirmed predictions but showed more variation in earth resistivity, some sections ranging up to 500,000 cm-ohms.



STEEL TOWERS on the Flesaker-Saaner 300-kv line in Norway require unusual grounding to prevent hazardous ground-potential gradients during L-G faults



SYSTEM IMPEDANCE FOR L-G FAULT is cut 70% by using 0.093-sq-in. copper-equivalent conductivity in lieu of ½-in. steel for shield wires

EARTH POTENTIAL, greatly reduced at faulted tower, is less reduced at tower more distant from fault location

Automatic Oscillographs Help Spot

Installed at major generating stations, they show limitations of protective relays and point to corrective measures

HERBERT M. PAUL, Engineer, Florida Power & Light Co, Miami, Fla.

Automatic oscillographs are being installed at major generating stations by Florida Power & Light to analyze equipment performance during fault conditions. The 32-channel oscillographs furnish information for improving system operations in at least four ways:

1. Make it possible to reduce the number and extent of transmission line outages caused by failure of both ends to reclose successfully following temporary flashovers. With oscillograph records showing the nature of the fault and the tripping and reclosing sequence of breakers at both terminals, the performances of relays and circuit breakers can be analyzed accurately and corrected.

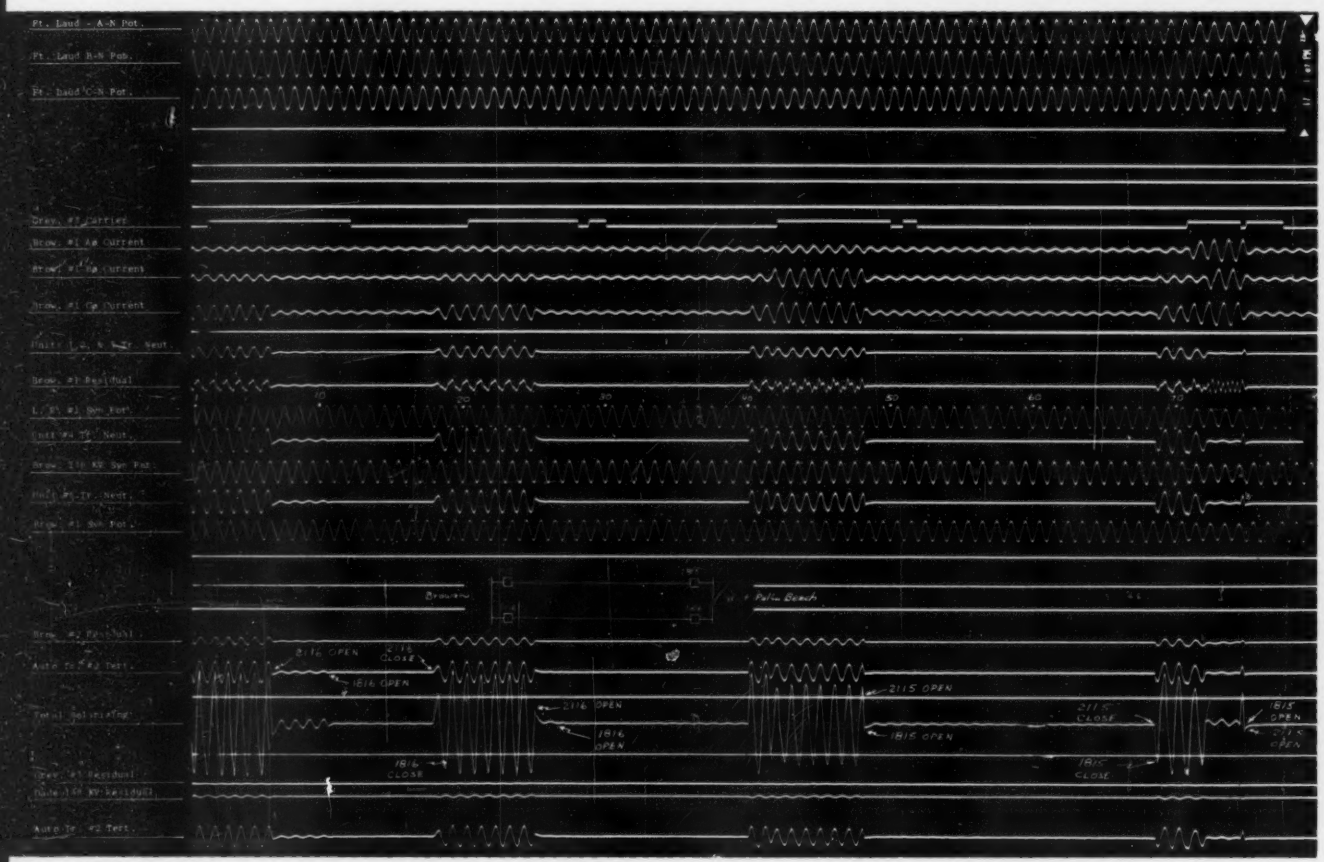
2. Oscillograph records during periods of system instability reveal the limitations of distance-type relaying on transmission ties and show where out-of-step blocking relays can be installed to prevent unnecessary separation at critical points. These records put the finger on out-of-step blocking relays that are not needed, a most important step as these relays are suspected of blocking for internal faults under certain conditions.

3. The records permit the testing of carrier relay schemes as well as continuous monitoring. This should reduce unnecessary breaker trips caused by malfunctioning of carrier relay schemes.

4. The oscillographs record the time of short circuits and furnish information for analysis of the sequence of operations.

Besides these improvements, the oscillographs provide a record of system behavior under different abnormal conditions. This information can be used to check calculations and equipment specifications.

Three installations have been made, the first at Lauderdale Station in 1959. The type selected as



TYPICAL FAULT RECORD shows tripping and reclosing speeds and the progression of the fault from single-phase-to-ground to three-phase-to-ground. Third harmonic current in the "Brow. No. 1 Residual" trace was due to saturation of the auxiliary CT's used for the phase current signals. Unequal pole opening of the breakers is shown by the large pip of ground current on the far right of the chart when the three-phase-to-ground fault was cleared

System Weaknesses

most suitable is a galvanometer light-beam-type recorder using photo-sensitive chart paper. When current galvanometers are used exclusively, as is the case for the three now in service, 32 independent channels are available. Bifiler galvanometers, which have a sensitivity of about 2.2 mm per ma per m of optical arm and a frequency response of 800 cps, are used. They have an optical arm of 0.346 m which gives an over-all sensitivity of 0.761 mm per ma.

2-Ft Chart Proves Satisfactory

Chart paper is 12 in. wide and travels at either 3 or 12 ips. Chart speed is selected by a toggle switch or by each starting relay independently. The 12-ips speed is preferred. A pre-wound spring accelerates the chart to full speed in about 2 msec, whereupon a dc motor operating from the 125-v station battery performs a smooth takeover and completes the cycle. Record length is adjustable from 2 to 20 ft. So far the 2-ft length has proved satisfactory. The chart runs until the cause of disturbance is removed or the supply of paper exhausted. Location, date, and time appear at the end of each record.

The oscillograph has a viewing screen at the front which facilitates positioning and calibration. Up to four starting relays can be housed in the main enclosure.

A sensitive over-current relay starts the oscillograph for ground faults. Its coil is connected to receive a secondary current proportional to the zero-sequence current supplied locally. For faults not involving ground the oscillograph is started by a sensitive voltage relay which detects a 3% decrease in 3-phase voltage, or a 9% decrease in phase-to-phase voltage. The potential source for this relay is subject to interruption by switching or blowing of fuses. For this reason, the oscillograph has a single-phase disabling relay which drops out in 10 sec for 50% voltage from the same source.

As the system voltages are essential to the analysis of disturbances, the instrument is connected so that the traces representing these voltages are at the top of the record. Other quantities recorded are:

1. Currents in transmission line ground relays, operating and polarizing coils.

2. Currents in transmission line phase relays.

3. Potentials for phase relays when a line-side source is used.

4. Synchronizing potentials for line and generator breakers.

5. Presence of relay carrier signals.

6. Position of relay contacts.

Even with a 32-channel oscillograph, it is impossible to record all quantities for every line terminal. Actual assignments of channels involve an analysis of past behavior of each line, and only frequent changes obtain optimum results. A separate channel was assigned for each ground relay polarizing current source to verify circuit connections and relative magnitudes. These channels will be re-assigned as required.

In a typical monitoring of a line terminal, the oscillograph is connected to record phase and ground currents, synchronizing potential and carrier signal. Auxiliary current transformers are used for current signals to isolate the oscillograph from other circuit elements, while nominal 60-cps potential signals are fed directly to the galvanometer resistor units. The station battery 125-v potential records the position of relay contacts for the carrier signal alarm relay.

To accommodate 32 signals on a chart, 12 in. or 305 mm wide, the nominal peak-to-peak deflection of each signal must be limited to about 10 mm. This is easily accomplished for potential signals as they seldom exceed their nominal value. But the initial calibration for current signals is a compromise between deflections obtained for maximum and minimum faults.

Current signals were arranged so that those giving large deflections for any one fault are widely spaced as they appear on the developed chart and, where possible, current signals are separated by a potential signal to reduce further the likelihood of overlapping.

Each oscillograph is located at a plant which is also headquarters for a division relay engineer. The latter is responsible for operating and maintaining the oscillograph. Channel assignments, calibration data and starting relay settings are prepared in the system relay office.

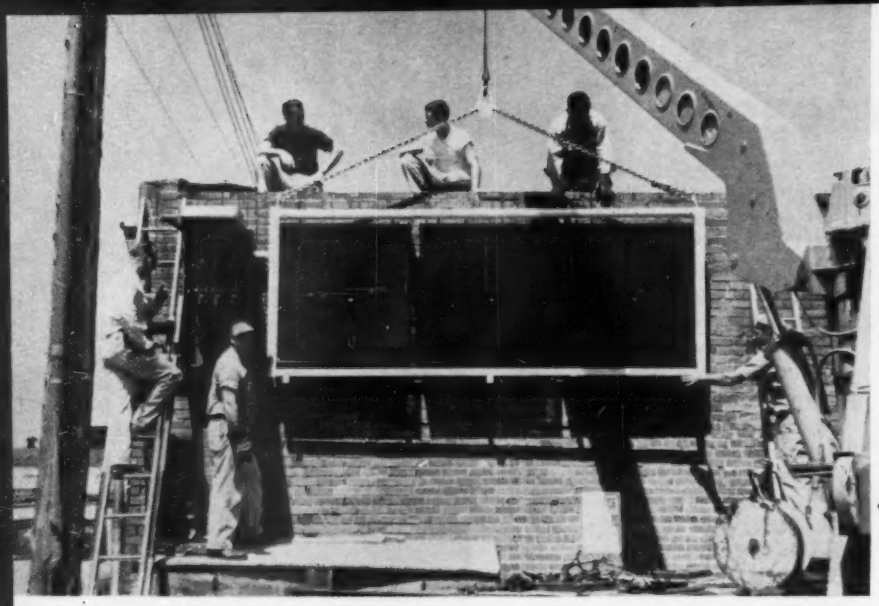
32-CHANNEL OSCILLOGRAPHS are being installed in all major generating stations to improve system operations

A small darkroom at each plant enables the division relay engineer to make preliminary analyses of records of a disturbance. The developed charts are forwarded to the system relay office for complete analysis, and comparison with other records and for filing.

During 1959 the Lauderdale oscillograph recorded 47 of the 52 faults on the lines from this plant. In addition, 17 of the 45 faults on other lines south of Lauderdale and nine of the 41 faults on the Broward-West Palm Beach double-circuit line were recorded.

Oscillograph records have verified the tripping speed and reclosing-time adjustment of breakers, established the time of fault, found grounded secondary current leads, and pointed to improvements in the carrier system.

Automatic oscillograph equipment used prior to 1959 was a six-channel portable type. It had the disadvantage of requiring too much time between the time of fault and the time a record could be made available and analyzed.



Capacitors

Raising power factor to 93% frees capacity, offers savings up to $400,000 over a 15-year operating period

SPECIAL HOISTING FRAME holds three cabinets in position after internal wiring on ground. 400-amp switch allows 270-kvar bank to be cut in, out

D. D. CANADA, Supervisor, Underground Dept, Oklahoma Gas & Electric Co, Oklahoma City, Okla.

As underground network systems are enlarged to accommodate the expansion of new commercial loads with accompanying low power factors, the gain in system capacity by the addition of capacitors grows in economic attractiveness. A study of the use of capacitors against the probable 15-year growth on the 120/208-v underground network in Oklahoma City brought forth these recommendations:

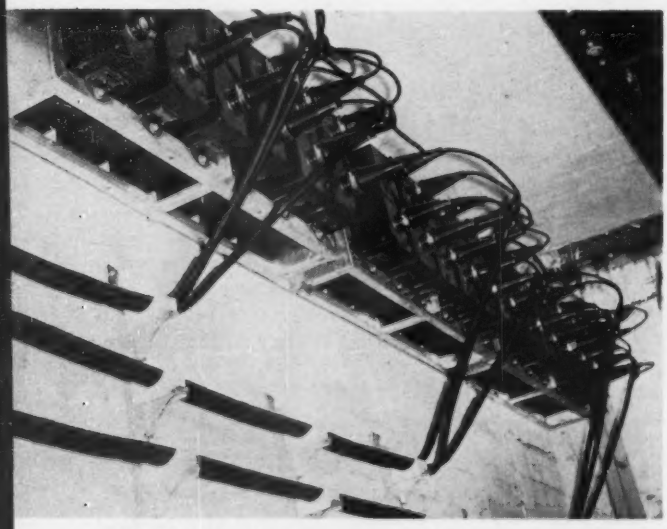
1. Fixed secondary capacitors offer savings of $340,000 to $400,000 over the 15-year period.

2. Sufficient capacitor kvar should be used to raise system's peak-load power factor from 84 to 93%.

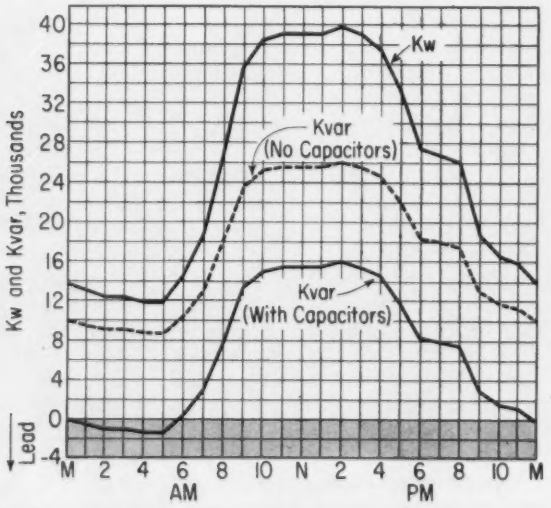
3. Capacitors should be added annually to maintain the annual peak load at 93% power factor.

Oklahoma Gas & Electric Co planned to have 10,116 kvar of capacitors on the network by the end of 1960. About 2,000 kvar of these units would be manually switched; the remainder, fixed. This discussion will cover the methods evolved to make the installations. It will also cover the economics.

Two plans had been developed for the expansion of the underground system through the year 1973. Plan I considered development of the underground system for 15 years without capacitors. Plan II covered development for the same period using fixed secondary capacitors. It was decided that capacitors should be added in sufficient quantity to raise the existing 84% power factor to 93% before a seventh underground feeder was required. After power factor was raised to



STANDARD RACK mounts six, 13.3-kvar, 216-v single-phase units delta-connected in vault or over transformer



OVER-ALL EFFECT of capacitors on the underground system is illustrated by kw and kvar for summer day in 1960

Boost 120/208-V Network Capability

93%, capacitors would be added to maintain the underground system power factor at 93% during peak load periods. Each plan was evaluated using the study premises listed in the accompanying table.

The equivalent uniform annual cost of development of the underground system for 15 years, excluding secondaries and services and without secondary capacitors, is $255,490. The equivalent uniform annual cost with fixed secondary capacitors on the 120/208-v side of network transformers to raise power factor from 84 to 93% is $226,712. Thus, the equivalent uniform annual savings each year for 15 years is $28,778.

Savings during the 15-year period will be about $340,000 if capacitors are installed at the transformers, and about $400,000 if capacitors are installed at the ends of services. Furthermore, it was shown to be economical to install capacitors up to 97% power factor at peak load each year as the load increases, without credit for reduced losses.

Voltage Improved

With the installation of capacitors on the underground system, additional benefits not evaluated in the study will be obtained. In some instances, short primary extensions or transformer changeouts may be deferred for a year or longer. Improvement in service voltage and customer relations will be provided by use of capacitors.

In planning for installation of capacitors, individual loads of customers were analyzed. After individual customer power factors were spotted on a network map, capacitor units were placed according to vault space and as close as possible to the customer's connection. Where vault space could not be obtained near the customer's service, outdoor wall units were used. However, the majority of capacitors were placed in transformer vaults or bus rooms.

The 80-kvar 3-phase standard unit seems to fit overall needs; 50 of these units were installed in 1959. This unit consists of six single-phase, 13.3-kvar, 216-v, delta-connected capacitors on a galvanized rack for mounting on a wall or floor or, in some cases, above the transformer. These standard units also are available in 40-kvar and 120-kvar ratings.

Each 13.3-kvar capacitor terminal is made watertight with a Neoprene boot clamped top and bottom with non-corrosive hose clamps. Under each boot is a high-interrupting-capacity fuse which screws onto the terminal and has a mechanical connection for individual wires of the capacitor.

This method is used to install capacitors in vaults. After the 80-kvar capacitor unit, which weighs about 520 lb, is taken to the job site, the six single capacitors are removed from the rack. The rack then is lowered into the vault and placed in position on the floor or secured to the wall with four ⅝-in. anchors. A base support at each end gives about 3-in. clearance for ventilation of floor-mounted racks. A case ground is connected to system neutral with a No. 6 wire.

Capacitor units weighing about 73 lb are lowered one at a time, placed in the rack, and bolted. They are next connected in delta, using a special mechanical-tee connection. From this connection, 250-MCM, 600-v rubber cable is run to the network or customer's tie. Limiters are used only when the capacitor is in a vault and the connection to the network or customer's tie is made in a manhole.

The assembled unit is placed in service by insulating two of the rubber cables and making a voltage check between the network and the third cable. If this check indicates zero or clear, the uninsulated cable is then connected to the network. The second cable is connected onto the network through a 200-amp, 5-kv cutout fused to carry about 180 amp. The third phase is then

(*Continued on page* 158)

Capacitor Study Based on These Premises

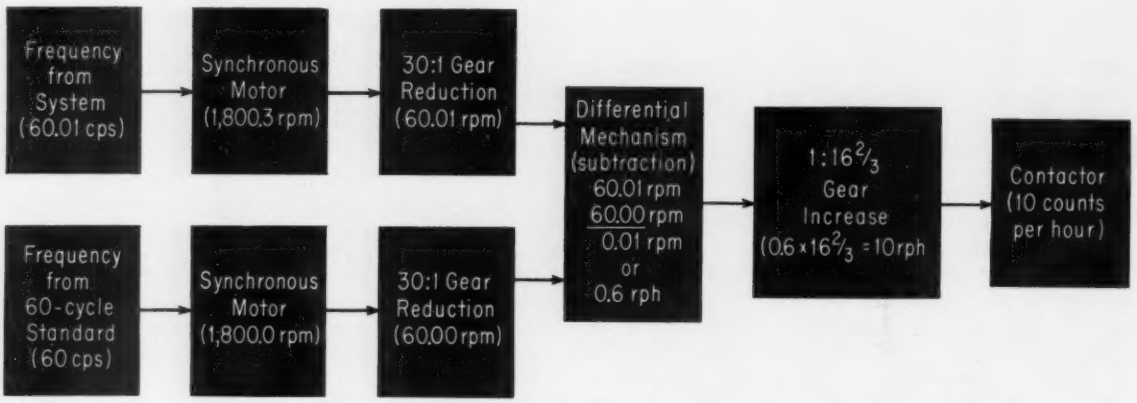
Estimated 1958 underground system peak load—36,090 kw; 23,040 kvar; 42,820 kva (84% power factor)

Average annual load growth—6%, compounded (for 15 years)

Power factor of new loads—84%

Peak load power factor, corrected to and maintained at 93%

Cost of components using a 9,000-kva feeder:	
Substation (feeder bay, OCB, regulator, reactor)	$3.50/kva
Underground primary cable	$10.35/kva
Vaults (including transformers and protectors)	$40.00/kva (nameplate)
Secondary cable, average	$4.00/kva of load
Services (average length 30 ft)	$3.00/kva
Ratio of installed kva of capacity to kva of load:	
Primary feeder, substation (one-feeder outage)	1.2
Network transformers (including associated gear)	1.62
Secondaries and services	1.00
Installed cost per kvar of capacitors:	
Overhead	$7.00
Underground	$24.00
System capacity released by raising power factor to 94%	0.46 kva/kvar installed
Capability of 375-amp 13.8-kv feeder based on:	
Ambient earth temperature	30C
Copper temperature	81C
Daily load factor (from tests in 1957)	65%
Cable	Three 1/c in duct
Fixed cost factor	13%/year
Annual underground system: Load factor	40%
Loss factor	24%
Incremental cost/kwhr of losses	1.6 mill
Annual demand charge for losses	$15/kw



DIFFERENTIAL SYSTEM in the integrator produces ten counts per hour when system frequency averages 60.01 cps for an hour. Deviation for current hour is averaged on one counter while reading for previous hour is on other

Integrator Gives Accurate Frequency Shift

ELMER C. FEWELL, Asst to Communication Supervisor, Union Electric Co, St. Louis, Mo.

Extreme reliability and accuracy are built into integrating equipment which provides an hourly determination of average frequency deviation for Union Electric Co load dispatchers. With the device the company's dispatching department is able to minimize unintentional interchange under tie-line bias control with neighboring systems. The value of the integrator has been proven during several months of operation.

Through its use, all errors, including those of the frequency meter, are known and can be included in computation of the offset to be applied to the load control console. Union Electric load dispatchers use a summation of all hourly interchange kwhr readings in comparison with total scheduled interchange to arrive at unintentional interchange. This value corrected for bias provides the error for the past hour.

An average of error figures for the last three hours then is used in the console as an offset. This offset is set into the schedule setter in a direction to counteract equipment error.

The system's bias (in Mw per 0.1 cycle) times the average deviation in system frequency from 60 cps (in 0.1 cycles) during the hour is the correction for bias operation. Frequency deviation must be determined for each hour. Dispatchers originally integrated this value visually from a 59.5-60.5 cps frequency meter. This method, however, was subject to errors, because its accuracy depended on meter calibration.

A more accurate method of determining this deviation is accomplished with an integrator which measures average frequency deviation from 60 cps during each hour. Basically, it compares a 60-cps standard with system frequency through a differential mechanism. This differential is so designed that a frequency deviation of 0.01 cycle over an hour registers ten impulses on a counter device. A single impulse, therefore, equals an average deviation of 0.001 cycle per hour.

The integrator consists of two identical fractional horsepower synchronous motors. One is energized from a 60-cps standard source; the other from the system. These are connected through gears to a differential mechanism. The motors were salvaged from retired telemetering instruments and the differential from a tie-line integration meter. Because the differential was designed for relatively slow speed operation, the motors are geared to the differential at 60 rpm.

To secure ten counts per hour, the speed of the differential output was increased by gearing. Relative speeds of the various items are shown in the block diagram.

Because the direction of rotation of the device depends on frequencies above or below 60 cps, two ratchet devices are included to operate individual shafts in opposite directions. These two shafts are provided with D-13 demand meter contacts (registering over and underfrequency) which are wired to an electrical pulse-operated "add-subtract" counter having a capacity of five digits.

Because the counter should be in operation for one hour only, a second counter is provided for the next hour. This alternate operation is accomplished through a latch relay, controlled through a one-hour interval clock in the load dispatching office.

The load dispatcher has one hour in which to read the previous hour's average frequency. After making his reading, he resets the counter by manually applying electric pulses to bring it back to read 60.000. Each counter, in turn, shows the average frequency for a clock-hour; from this the deviation from 60-cps is readily available. This deviation and the bias setting allow the load dispatcher to obtain the bias obligation for the hour.

THIS HIGH-VOLTAGE CURRENT-LIMITING FUSE...

Just interrupted 60,000 amps!

This General Electric EJ-2 current-limiting fuse just interrupted a damaging short circuit—without discharge or noise. You know, because the protruding indicator on the ferrule tells you so. (A cupped disc indicates operation for some types and ratings in General Electric's non-expulsion line.)

Because there is no discharge, G-E non-expulsion fuses do not need vents, mufflers, or reinforced cubicles. Less space is required.

Available in all standard voltage ratings from 600 to 34,500, and in a wide range of amperage ratings, these fuses are sure to meet your requirements for protection of capacitors, motors, transformers, load centers, and feeder circuits, and for general purpose duty. They're available for use indoors or out.

Want more information? Contact your G-E sales representative. Or write to Section 497-02, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

Line crew from Tampa Electric Co. installs G-E Permalex transformer at Medallion home site at Carrollwood, Tampa, Florida.

The challenge— 60,000 new medallion homes to serve in '61

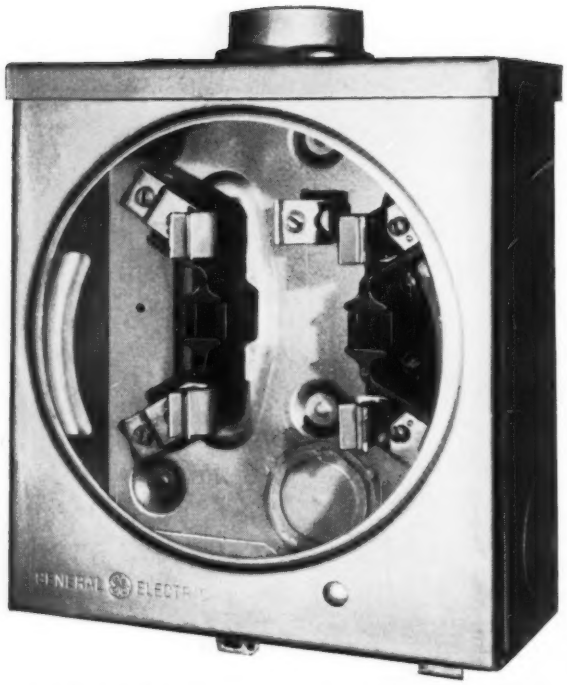
General Electric Permalex® distribution transformers can help you meet this challenge — economically.

The Gold Medallion of all-electric living will be installed on over 20,000 homes in 1961 . . . the Bronze Medallion on another 40,000. With this desire to "Live Better Electrically" comes the problem of economical expansion of distribution systems.

Through standardization on preferred-kva Permalex transformers, you can lower your total transformer owning costs five ways: (1) lower changeout costs; (2) lower operating costs; (3) lower inventory costs; (4) lower ordering costs, and (5) lower initial cost. Take advantage of these dollar-saving opportunities to hold your expansion costs to a minimum. Your General Electric Sales Engineer can show you how. 482-21

Progress Is Our Most Important Product

GENERAL ELECTRIC



NEW Low-Price SI-60 Ringless Sockets

General Electric announces . . . another new line of sockets, the SI-60 for 100- and 200-amp services. Meets requirements of AEIC-EEI-NEMA standards for meter sockets. *Ringless Weatherproof Construction* provides maximum protection. And, G.E.'s new SI-60 line offers exclusive features never before available in a ringless design. *New Terminal Block Assembly* with exclusive one-piece combination jaw and connector strap increases reliability . . . permits an unbroken current path from meter blades to line or load wires . . . provides excellent electrical conductivity with low heat rise. *New Plug-in 5th or 6th Terminal* simplifies shop or field conversion . . . installs in seconds, without the use of tools.

New General Electric Line of SI-60 Sockets also feature 16-gauge zinc-coated steel*. *Die-cast Hubs*, of corrosion-resistant aluminum . . . available in all popular hub sizes up to 2½-inches. *Lay-in Wire Connectors* accommodate either aluminum or copper wire. *Concentric Knockouts* are on both sides, back and bottom; for 1, 1¼, 1½-inch conduit. Your choice of *Large Case Size*—3 sizes in 100-amp, 2 sizes in 200-amp—permits fast, easy wiring.

NOW AVAILABLE in 100- and 200-amp ratings. Available soon with manual by-pass. Contact your G-E Sales Office or authorized G-E distributor for full information. Or write General Electric Co., Somersworth, N. H.

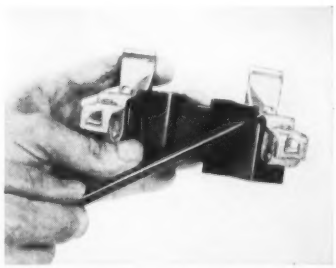
* *Also available in aluminum.*

711-02

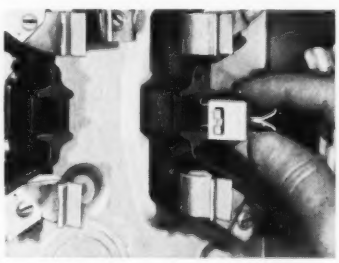
METER DEPARTMENT

GENERAL ELECTRIC

WEATHERPROOF RINGLESS CONSTRUCTION meets AEIC-EEI-NEMA standards. Case is 16-gauge zinc-coated steel with oven-baked finish. Hubs are die-cast of aluminum; staked to case for rigid, weatherproof fit.



EXCLUSIVE ONE-PIECE combination jaw and connector strap—in new terminal block—permits an unbroken current path from meter blades to line or load wires . . . provides greater reliability.



NEW PLUG-IN 5TH OR 6TH TERMINAL, another General Electric exclusive in ringless sockets, installs in seconds—without tools—greatly simplifies shop or field conversion.

Electrical World Report

MARCH-APRIL 1961

ELECTRIC utility methods

CONSTRUCTION • OPERATION • MAINTENANCE

'Flexibility' Achieves Low Cost and Efficient Right-of-way Clearing
Conventional and new equipment, plus flexible techniques, make for efficient clearing of Carolina P&L Co's right-of-ways — p 76

Pulsating Panels Insure Uninterrupted Coal Flow to Cyclones
Heating of bunkered coal, flow interruptions, are minimized or eliminated with air-panels at Detroit Edison Co — p 78

Incipient Transformer Faults Detected by Gas Analyses
Analyzing flammable gas concentrations blanketed above transformer oil aids Baltimore G&E Co to eliminate hazard — p 80

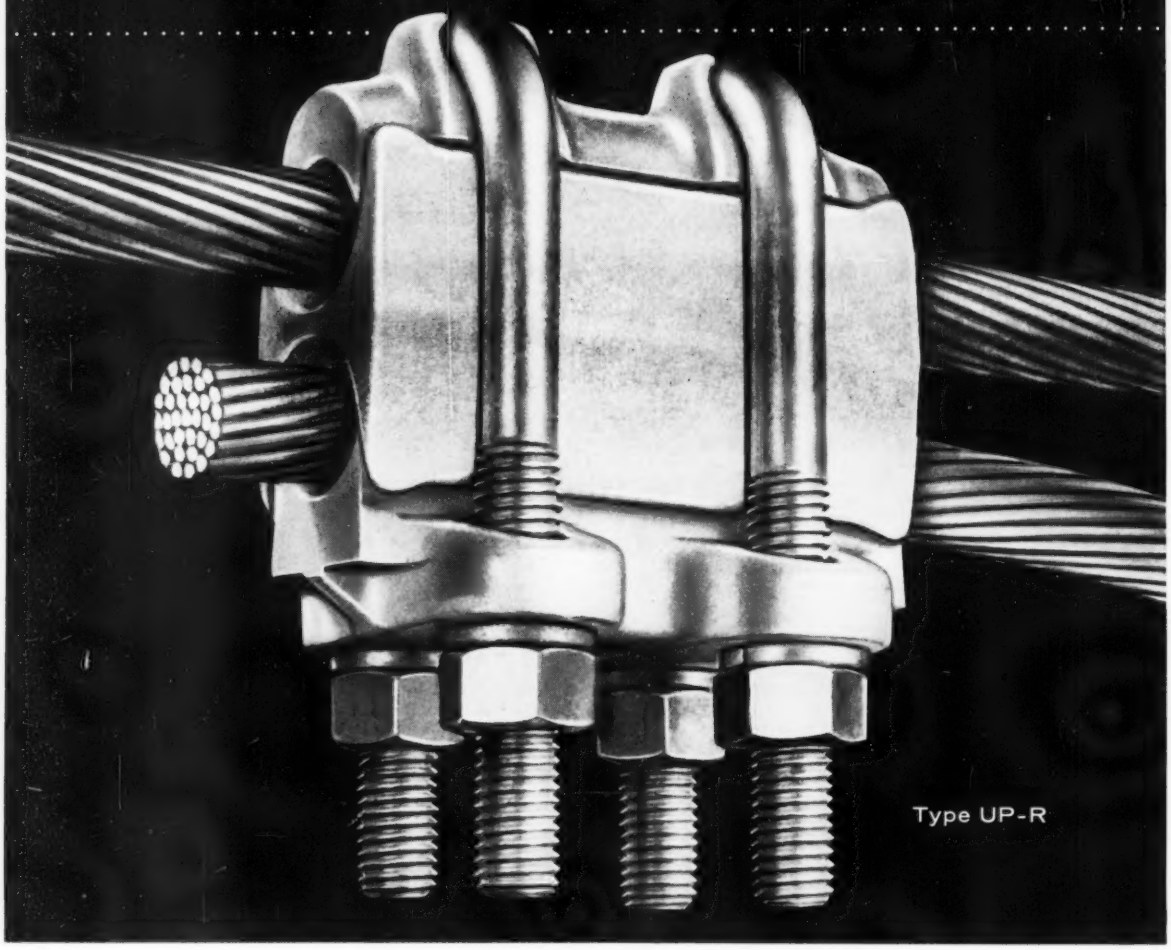
Regular Departments

Construction — p 84
Operation & Testing — p 92
Maintenance & Repair — p 97
Stores & Shops — p 112
Safety — p 108

New Equipment — p 63
Manufacturers Literature — p 118

where **POWER** counts

in transmission and primary distribution



COUNT ON

Heavy duty all-aluminum construction that offers overload protection • Modified V-grooves that assure good conductivity and cable wiping, and minimizes cold flow • Massive aluminum design that reduces galvanic corrosion • Belled mouths that prevent cable chafing • Three sizes that cover ranges from 3/0 through 954 aluminum and copper—110.8 through 795 ACSR.

Write for further details.

BURNDY

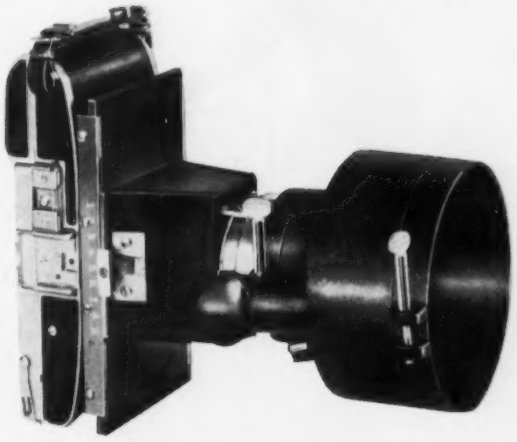
58-25

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

To obtain more information on these items, use code numbers indicated for the items when filling in Reader Service Card

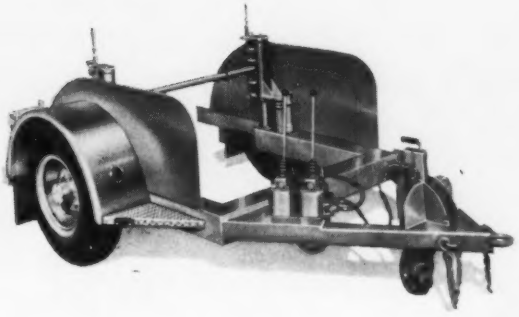
NEW EQUIPMENT

Oscilloscope Trace Recording Camera . . .



. . . makes nine exposures on a single polaroid print, by using the polaroid-land camera back in a special sliding mount. Model SM-209 scope camera is snapped into any of nine positively indexed positions. Using type 42 or 47 polaroid picture rolls, finished prints may be obtained 10 sec after exposure. The camera has a f/1.9 Wollensak Oscillo-Raptar 75 mm, anastigmat-coated lens, designed specifically for high resolution oscilloscope photography. Object-to-image ratio is 1:0.9, allowing virtually actual-size pictures. A new-type housing, in place of conventional bellows, avoids light leakage problems and a calibrated focusing scale allows the camera to be used on many different scopes.

Electronic Tube Corp, 1200 E Mermaid Lane, Philadelphia 18, Pa. (1)



Cable Reel Trailer . . .

. . . can be loaded and attached by one man to towing vehicles without the aid of a crane or winch. Two hand-operated pumps with independent hydraulic cylinders permit the operator effortlessly to elevate and level the reel to payout or travel position. Three sizes are available: Series RM-8, RM-10, and RM-12 for carry reels up to 54 in. wide and 96 in. dia and weighing up to 8,000, 10,000, and 12,000 lb.

McCabe-Powers Body Co, 5900 N Broadway, St. Louis 15, Mo. (2)

Insulator Clamp Adapter . . .

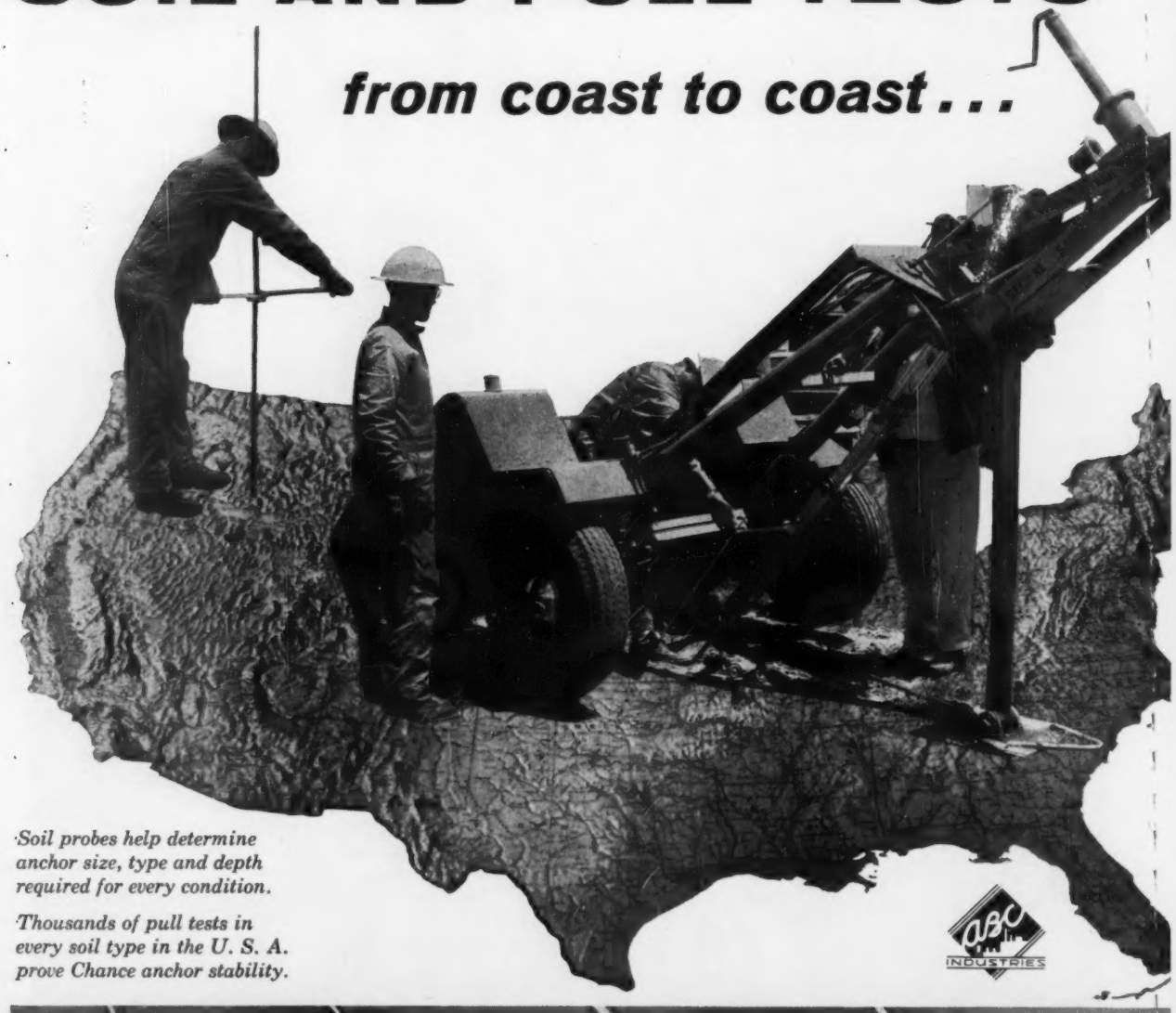
. . . for groove-top line insulators eliminates tie-down wires and armor rodding to simplify hazardous and difficult repairs on hot lines. The Unicon clamp adapter cuts to minutes repair jobs which are normally time consuming. No special tools are required. The adapter can be attached to all standard-sized insulators with neck sizes from 2½ to 4 in. dia and it takes all ACSR conductors from No. 4 through 336.4 MCM 30/7. The clamp keeper is reversible: one side will accept No. 4 ACSR through 1/0 ACSR and by being reversed will clamp conductor sizes 4/0, 336.4 MCM 18/1, and 336.4 MCM 30/7.

Lindsey Mfg Co, 222 Vista Ave, Pasadena, Calif. (3)

(More New Equipment on page 66)

SOIL AND PULL TESTS

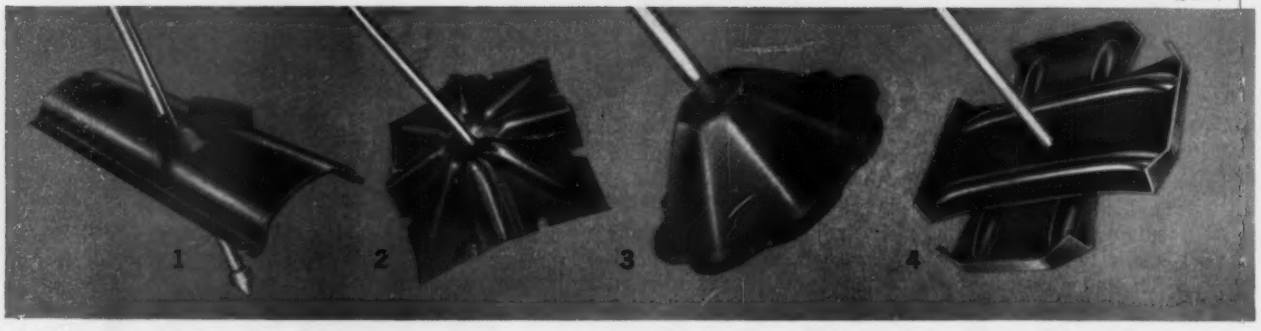
from coast to coast . . .



Soil probes help determine anchor size, type and depth required for every condition.

Thousands of pull tests in every soil type in the U. S. A. prove Chance anchor stability.

ABC INDUSTRIES



1. NEVER-CREEP ANCHOR Pulls entirely against solid, undisturbed earth. Holds more load than any other type of anchor.

2. 8 WAY EXPANDING ANCHOR Slips down a hole no bigger than the base plate. 8 rib reinforced blades expand into solid earth all the way around.

3. STEEL CONE ANCHOR Cuts the cost of guying in hardpan, adobe clay, or rocky soil. Gives exceptional holding strength.

4. CROSS-PLATE ANCHOR For guying "big stuff" like transmission lines. Installs in vertical machine bored holes. Costs 50% less than a log dead-man - - holds more.

...part of the research behind the product you get when you buy

Chance Anchors

There's a great deal more than metal fabrication behind A. B. Chance Company anchor production. Soil analysis, trial installations and pull tests under *every conceivable condition* have been a part of the development of every anchor. Many power companies have cooperated in this nation-wide program to improve anchors and anchoring techniques. If you have taken part in this activity, you know something about the Chance Company's internal development work that goes far beyond field tests to give you a better product; to fit anchors to modern mechanics and to the specific soil conditions involved, and to simplify handling, stocking and identification of the product in your storage and on the job.

These are the reasons why you can have complete confidence when you buy Chance Anchors. The fact that stocks are available to you or your supplier within 48 hours (usually much less) from any one of ten Chance Servi-Centers across the nation gives you another good reason for specifying Chance.

A. B. CHANCE CO. CENTRALIA, MISSOURI

A. B. Chance Co. of Canada, Ltd., Toronto

5. SWAMP ANCHOR For difficult swamp guying. Screws down to any depth required to get sufficient holding power.

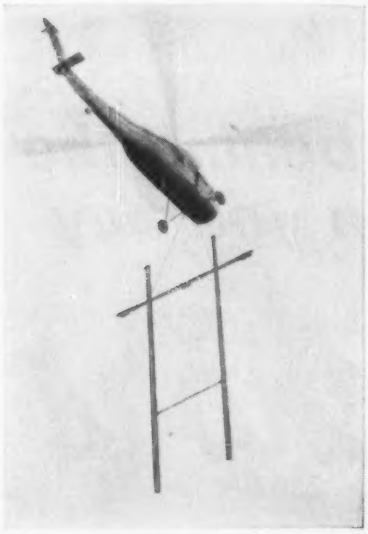
6. FOUNDATION ANCHOR New . . . for installing transformers without concrete pads! Provide a solid "foundation" for "pad-mounted" or power transformers.

7. NO-WRENCH SCREW ANCHOR Pitch-controlled blade goes down fast, adds to holding power. Can be installed by hand.

8. POWER SCREW ANCHOR Lets you mechanize screw anchor installation with your power hole-digging equipment. Anchors install in 6 to 8 man minutes.

9. EXPANDING ROCK ANCHOR Expands and wedges against solid walls of rock. Does away with expensive lead or concrete grouting.

CA61-11



Keeping Pace with Progress —

Haley's

uses the most modern plants to produce

— Pentachlorophenol Treated —

WESTERN RED CEDAR POLES

and

DOUGLAS FIR CROSSARMS

Our modern treating and fabricating equipment, storage yards and shipping service means we can serve you better, faster than ever before.

Plants at
Bellingham, Washington
Minneapolis, Minnesota
and
Findlay, Ohio

R. G. HALEY & CO., INC.
Spitzer Bldg., Toledo 4, Ohio

Ladder Tester . . .

. . . for safety inspection weighs only 25 lb for mobility. It applies thrust to ladder rungs, quickly recording it on direct-reading gage. Operator, observing gage, can determine the exact breaking point of a defective rung and prevent in advance what could have been a serious accident. Releasing thrust unlocks rung clamp automatically. Operator can change thrust adjustment from 1 to 600 lb.
Hydraulic Systems, Inc, Philadelphia 40, Pa. (4)

'Compact' Scope . . .

. . . is for field use. Primer-Scope, Mark I is said to be a simple, small (7¼ x 3½ x 11¼-in.) scope, adaptable to numerous testing and experimental applications. Its light weight (under 6 lb) favors inclusion in heavy service kits. Accelerate potential is about 840 v; trace is bright and sharp. It measures ac from 6 mv up.
Waterman Products Co, 2445 Emerald St, Philadelphia, Pa. (5)

Lift Truck . . .

. . . provides up to 46,000 lb of lifting capacity with less than 5% weight increase over the smaller Challenger 400 unit. The new Challenger 460A is standard rated at 46,000 lb at a 48-in. load center. The new design's wheel base has been lengthened and a completely new hydraulic system added.
Hyster Co, Box 847, Canville, Ill. (6)

Insulation Sleeving . . .

. . . resists heat and oil attack, also acid and fungus. Resinite Hi-Heat 105C is a transparent vinyl insulation sleeving designed for electric motor insulation and for application over transformer leads. Dielectric strength is 1 kv per mil average; working temperature is from 221F to —10F, with continuous operation at 105C. Tensile strength is 2,900 psi minimum and burst strength is 75 psi. The sleeving material maintains complete flexibility after 1,000 hr at 125C. The material is self-extinguishing in 5 sec. In addition to the transparent type, the new insulation sleeving is also available in ten colors, standard sizes from No. 24AWG through 2½-in. ID and specified wall thicknesses.
Borden Chemical Co, 1 Clark St, North Andover, Mass. (15)

Adjustable From 1 to 15 Seconds

This new Allen-Bradley development should solve such occasional problems where, upon the operation of the push button or limit switch, a slight time delay should occur. Time delay is adjustable up to 15 seconds—and it can also be introduced when "stopping" the operation—but not in both the "starting" and "stopping" cycle.

Both push-button and limit switch are relatively low in cost—ideal for applications where a delay of only a few seconds is desired, and where the repetitive accuracy of the Allen-Bradley Bulletin 849 time delay relay is not necessary. Both units have single pole, double break contacts—either normally open or normally closed. They are no more difficult to install than the corresponding units without the time delay feature.

Machine tool and production system designers should have full information in their files on these new Allen-Bradley time delay push buttons and limit switches. It is yours for the asking. Write today.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1327 S. First St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

CIRCLE 67 ON READER SERVICE CARD

The Galvanized Steel Strand with the built-in raincoat

Everybody talks about the weather . . . CF&I *does* something about it. To protect Galvanized Steel Strand against corrosion, CF&I builds in a zinc coating that shrugs off moisture. The result is a long-lasting, weather-resistant steel strand that is ideal for overhead ground wire and meets ASTM specification A-363.

Also highly suitable for guying assignments, CF&I Galvanized Steel Strand is made in seven- or three-wire constructions . . . in accordance with ASTM specification A-122. In addition, it can be tailor made to meet your particular specifications.

Like all CF&I products, Galvanized Steel Strand is made by a nationwide company to meet high American standards. For immediate delivery, contact your nearby CF&I warehouse or your local electrical distributor.

THE COLORADO FUEL AND IRON CORPORATION
Denver • Oakland • New York
Sales offices in All Key Cities

68 CIRCLE 68 ON READER SERVICE CARD

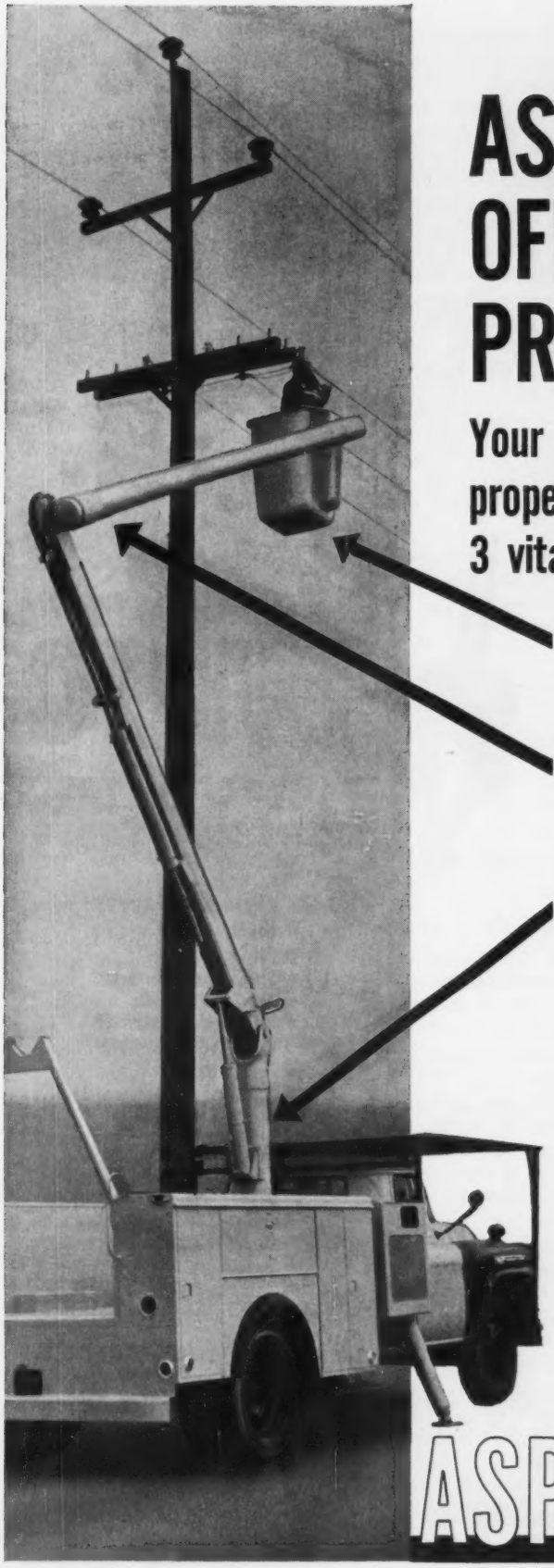
Cable Tracer . . .

. . . allows one man to trace cables more quickly. He can locate up to ten conductors or pairs at once, without the need for buzzers, bells or a helper. Amprobe cable tracer consists of the tester and ten numbered station blocks. A panel light illuminates the number of each conductor being tested which corresponds to the station block light number. This eliminates needless handling of wires to locate conductors to be tested. The tracer is completely self-powered, compact (less than 6 in. long) and is said to offer a foolproof way for testing opens and shorts. The receptacle takes up to No. 10 wire directly; alligator clip leads are provided for larger sized wires.

Pyramid Instrument Corp, 630 Merrick Rd, Lynbrook, L. I., N. Y. **(7)**

Preventives . . .

. . . for poison ivy and poison oak are taken orally or injected intramuscularly by a physician. Imun-Ivy and ImunOak afford protection against all members of the Rhus family, including poison sumac. Most companies are said



ASPLUNDH OFFERS COMPLETE PROTECTION

Your Aerial Device MUST be properly insulated at these 3 vital areas

1. THE BASKET

Asplundh provides a removable Insert Liner*
*certified to 50,000 volts

2. THE UPPER BOOM

The Asplundh Upper Boom is made of a nonconductive material.

3. THE MAST

The Asplundh Pylon Mast Insert protects against an energized truck.

If these three places are not fully insulated, then you do not have *complete* insulation. You are not protecting both the man in the basket and the man in the street. Be sure, have your safety director investigate how you protect the worker and the public with an Asplundh Aerial Lift. The Asplundh Aerial Device gives you complete insulation from ground.

Write today for your free copy of our booklet on Proper Insulation

ASPLUNDH Chipper Company
Hamilton St., Chalfont, Pa.

THE ELECTRICAL TESTER
by MULTI-AMP®

MULTI-AMP TEST SYSTEMS

PROVIDE CONTINUOUS POWER FOR CONTINUOUS PRODUCTION

MULTI-AMP Div. Multi-Amp Electronic Corp.

HUMBLE CURBS ELECTRICAL HAZARDS WITH BREAKER TEST PROGRAM

Operational upsets and downtime have been cut to a minimum at Humble's Bayway Refinery, Linden, New Jersey, through the use of a planned circuit breaker maintenance program aimed at checking the tripping characteristics of breakers at each of the refinery's substations.

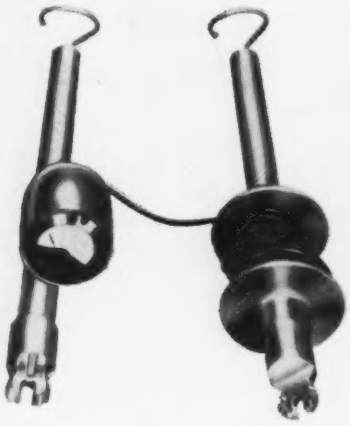
The job is being handled safely, rapidly and economically with a MULTI - AMP tester having an output transformer with a variable cross-section multi-tap secondary to provide up to 6,000 amperes at 2.5 volts with an input of 480 volts. The tester has a built-in timer which indicates the breaker trip time in seconds and cycles.

For the full story of Humble's breaker maintenance program read the technical article by Maintenance Engineer Henry S. Orth. You will find it in Volume 3, No. 1 of our publication, The Electrical Tester.

M 504

Free copy on request. Call or write MULTI-AMP Division, MULTI-AMP ELECTRONIC CORP., 465 F Lehigh Avenue, Union, N. J. — MU 8-7112

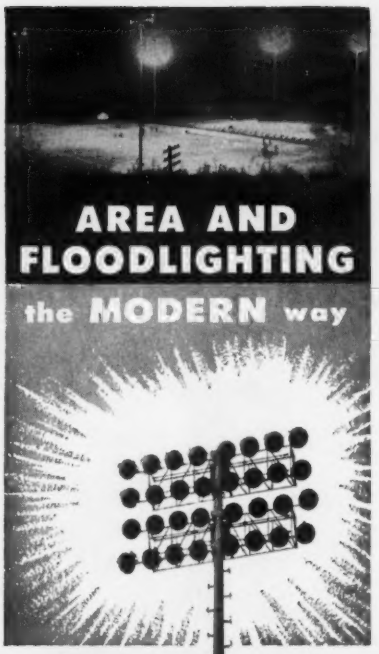
to offer them to employees in early spring; some recommend their use in the spring and fall; others recommend their use monthly. Both poison preventives are packaged in 1-oz, nonbreakable vials: four to a single-unit pack and each unit wrapped in waterproof polyethylene. Usual dosage is one vial in ⅓ glass of water, milk or fruit juice, two days in succession—followed by one vial every month until frost destroys the plants.
E. D. Bullard Co, 2680 Bridgeway, Sausalito, Calif. (8)



Phase Tester . . .

. . . determines correct phase relationship before joining circuits. Basic unit is for up to 15 kv; extension resistors are available to adapt the tester for 15 to 75 kv. Tester consists of two high resistant units and a voltmeter mounted on two epoxiglas, insulated housings. The two housings are joined by 20 ft of 15-kv insulated, flexible cable (which is normally stored on a cable reel mounted on one of the housings). A lineman can safely hook the resistor hooks over the conductors by means of universal poles connected to the bottom of the housings. Tester is first connected across phases on each line to determine if both are energized—then hooked over each conductor to check the phase.
A. B. Chance Co, Centralia, Mo. (9)

(More New Equipment, p 71)

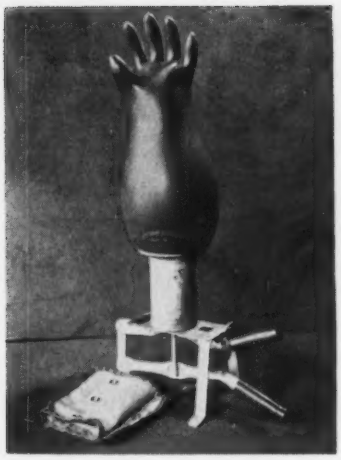


TULITO
TAPERED STEEL LIGHTING TUBES

For
- Baseball Diamonds
- Football Fields
- Playgrounds
- Shopping Centers
- Truck Terminals
- Railroad Yards
- Race Tracks
- Radio and TV Towers
- Transmission Power Lines

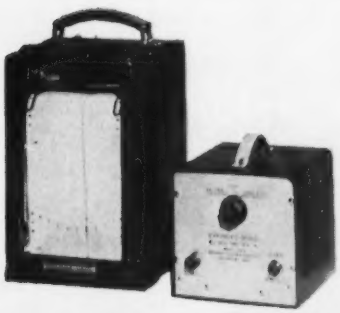
Engineered for Permanence, Strength and Safety . . .
Designed to accommodate from 2 to 40 lights.
Streamlined to enhance the appearance of any lighted area.

MEYER MACHINE, INC.
RED WING, MINNESOTA



Glove Tester . . .

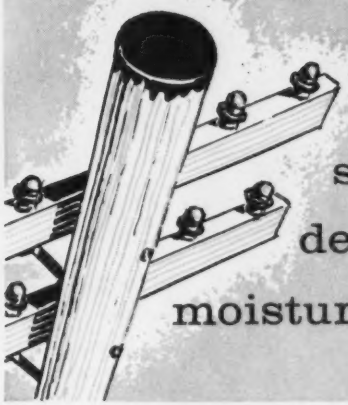
. . . is for field use, allows detection of even hairline cracks or pinpoint leaks. Testing operation can be accomplished in less than 3 min. The New/Matic portable tester, made of noncorrosive steel, comes in two sizes which are designed to fit all linemen's regular-size rubber gloves. Weighing only 6 lb, tester can be included as standard equipment on line trucks. Operation consists merely of clamping glove over top of tester, hand-inflating it (see lever) and then inspecting it. **E. D. Bullard Co, 2680 Bridgeway, Sausalito, Calif. (10)**



Voltmeter-Recorder...

. . . monitors voltage fluctuations. An expanded scale instrument, Model 1122B-60 operates with a high torque, 12-ma recorder designed to provide chart deflections with amplitudes two to three times greater than standard

New CHAPMAN POL-KAP



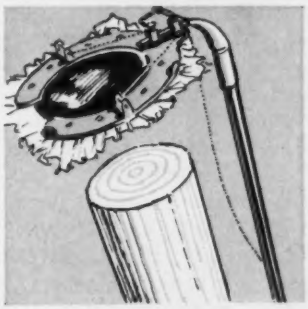
stops pole top decay...seals out moisture permanently

This new pole maintenance aid from Chapman Chemical Company is a pad of Chapman Pol-Nu preservative grease, which contains 10% pentachlorophenol, with the addition of a special mastic compound. When applied to a pole top the Pol-Kap adheres permanently, forming a uniform protective cover to seal out moisture. The penta solution is released into the wood to kill existing decay and prevent its recurrence.

Unique packaging—The Pol-Kap is prepared in a sealed, ready-to-use package made of a water-soluble (but oil insoluble) film which is dissolved by rainfall, leaving only the continuous smooth layer of permanent preservative grease on the pole roof.

Easily, safely applied with special Pol-Kap Applicator

This special applicator mounts on the end of a hot stick and enables a lineman to apply the Pol-Kap without having to climb above hot wires. It takes only a few seconds to position the preservative pad which forms a permanent protective covering that won't crack or check and can't be blown off pole top.



CHAPMAN CHEMICAL COMPANY
Leading manufacturer of wood preservatives
Memphis 1, Tennessee

CHAPMAN®
Pol-Kap

MAIL FOR COMPLETE INFORMATION
Chapman Chemical Company
P. O. Box 138, Memphis 1, Tenn.
Please send literature on the Pol-Kap to:

Name_____
Company_____
Address_____

field
proven
FIBERGLAS
HOT STICKS
by BODENDIECK
Still setting quality standards . . . since 1952 . . . and additional benefits have been enjoyed from other BODENDIECK developments:
● FAST ACTING SPIN-TITE CHAIN BINDERS ON POLE MOUNTING EQUIPMENT
● ONE VERSATILE LINE GUARD SYSTEM FOR 6.9 THROUGH 34.5 KV
● LOW, EASY TO WORK TOOL TRAILERS WITH 100% USABLE INTERIORS
● COMPACT INTERNAL FERRULE HEADS ON (MEDALLION) HOT STICKS REDUCE EXPOSED METAL 50%
Line personnel can plan the best possible means to accomplish their jobs with BODENDIECK'S catalog . . . a low cost, simplified ordering guide intended for wide distribution. Send for as many copies as you like and also receive full information on FIBERGLAS HOT STICKS and VERSATILE LINE GUARDS.
BODENDIECK
TOOL CO., / TAYLORVILLE, ILLINOIS

voltmeters. The voltmeter uses no tubes or transistors and responds fully to 100 msec pulse, compared with approximately 1 sec for a dynamometer-type unit, or ½ sec for a rectifier type. The instrument is sensitive to fluctuations as small as 0.25 v in a 120-v system. The voltmeter is available in a carrying case or rack-mounted.

Brenner-Fiedler, 7563 Melrose Ave., Los Angeles, Calif. (11)

Safety Vest . . .

. . . is flame-red fluorescent vinyl-coated nylon. The new high-visibility vest is for utility linemen working on streets and highways, as well as in other locations where seeing them is important to their safety. Light in weight, it does not interfere with movement in any direction. It comes in universal sizes to fit all men.

Albert W. Pendergast Safety Equipment Co, Tulip & Longshore, Philadelphia 35, Pa. (12)

Hot Line Clamp . . .

. . . is tightened by the lever-and-fulcrum principle, rather than the bolt-and-slider method. Friction which occurs in the older method is eliminated; greater pressure is permitted on the conductor to create a tighter, longer-lasting connection. Clamp has bell-mouthed and wire-bearing

HARPER AVAILABILITY
. . . fastenings at your fingertips!
Immediately available, from stocks in local distributor and factory warehouses, are millions of fastenings in over 7,000 different sizes, shapes and alloys to meet your critical demands. Harper maintains a constant inventory of more than 150,000,000 bolts, nuts, screws, washers and rivets in over 100 non-ferrous and stainless steel alloys to make this service possible. Even "specials" made to your specifications are promptly processed through Harper's completely integrated operation to meet your requirements. Availability of fastenings is a fact with Harper. Call your local Harper Distributor or branch office today for proof!
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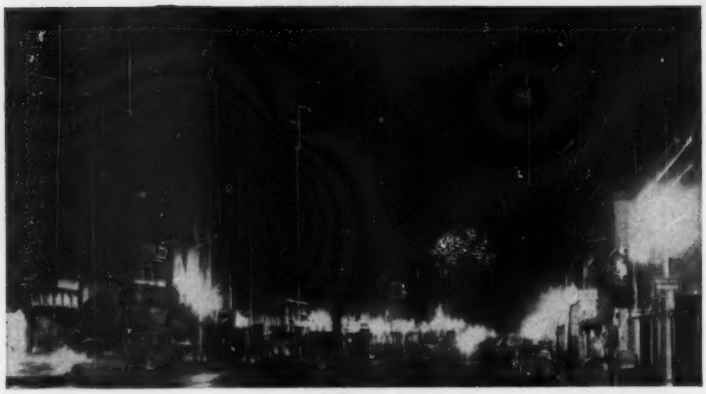
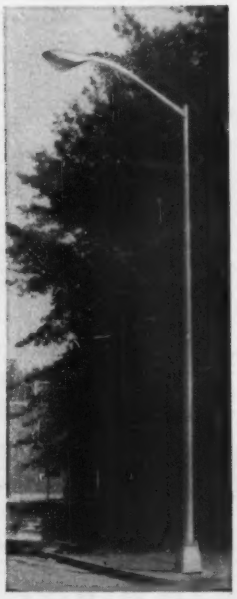
shaping metals
that shape your future
HARPER



WHAT A DIFFERENCE!

What a beautiful difference P & K ALL-ALUMINUM LIGHTING STANDARDS can make in any community



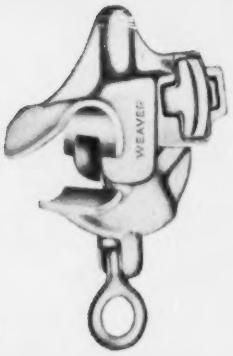
This is High Street, Pottstown Borough, Pa., a busy shopping section and a major traffic artery. As part of a planned relighting program, Philadelphia Electric Company replaced the old-fashioned, inadequate cast iron standards with modern, 30-foot tapered aluminum standards by P & K; replaced the incandescent luminaires with mercury vapor.

The difference is tremendous—by night, safe well-lit streets that are an invitation to shoppers; by day, handsome, modern looking standards that reflect a progressive community. And, it's good to know that P & K standards never need painting or other costly maintenance. For the complete data on P & K street and area lighting standards, please write.

P&K

PFAFF & KENDALL
84 Foundry Street, Newark 5, N. J.

Branch Sales Office: San Jose, California
In Canada: Powerlite Devices LTD., Toronto, Montreal, Vancouver
Export Representative: Philips Export Co., N. Y., N. Y.



surfaces, machined to avoid damage to the conductor. Maximum length of the exceptionally long contact area can be effectively tightened with a single bolt and a heavy spring assures constant pressure on the conductor. When the clamp is open, the saddle drops out of the way for easier installation. Carefully designed ears seat firmly in the hot stick, and the lever-fulcrum is said to reduce greatly the number of turns required to open and close the clamp.

J. A. Weaver Co, 2110 Howard St, St. Louis, Mo. (13)

Medicinal Spray . . .

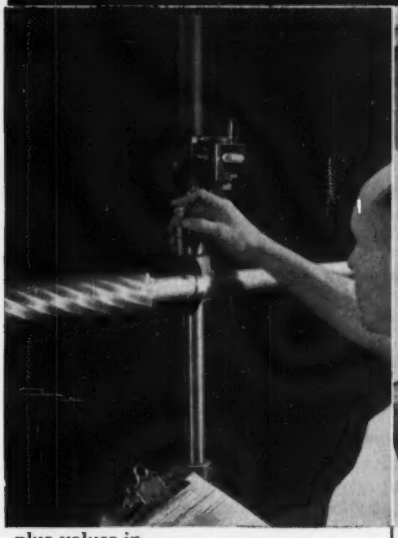
. . . for pain relief from burns was developed to speed healing. The G-63 spray, which contains hexachlorophene and an analgesic agent, coats the skin with a protective film to guard against secondary infection and obviate bandaging. It is furnished in 8-oz aerosol cans.

General Scientific Equipment Co, Box 3038, Philadelphia, Pa. (14)

Your best conductor protection is **ARMOR RODS**
and the best armor rods are

FANNER Superforms*

SUPERFORMED BY THE WORLD'S FIRST MAKER OF MACHINE-MADE ARMOR RODS



plus values in
RESEARCH/DEVELOPMENT
Punishing tests, indoors and outdoors, are constantly conducted for product improvement and new developments.

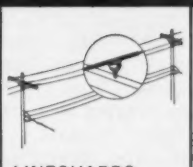
plus values in
RAW MATERIALS
Exacting tests and material inspection assure the finest quality in all Fanner Superformed products.

plus values in
PRECISION MANUFACTURE
Scrupulous care in manufacturing, in testing, in handling and in packaging assure on-the-job dependability.

Of course you use armor rods for their economy and safety in construction, maintenance and repair of overhead lines. But, above all, you buy them because they are the most *dependable* accessory yet developed for protecting overhead conductors against wind-induced vibration at supporting points.

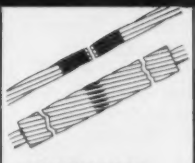
Fanner Superforms are of the highest quality. At every step . . . in development, materials, manufacture and packaging . . . Fanner takes extra care to give you the finest armor rods available, *at no extra cost*. Ask our representative for details. He will give you *plus assistance with your T&D problems*, too!

ARMOR RODS
. . . Protect long spans at supports



LINEGUARDS
. . . Protect short spans at supports

FANNGRIPS
. . . For dead-ending strands or conductors



FANNSPLICES
. . . For joining or patching strands

TREEGUARDS
. . . Protect conductor surface covering

KOVER-GARDS
. . . Protect surface-mounted conductors

*A superior forming method in accordance with Patents No. 2,769,478 and 2,588,663—other patents applied for.

THE FANNER MANUFACTURING COMPANY
Brookside Park • Cleveland 9, Ohio

DIVISION OF TEXTRON, INC.

Fine Fanner Superformed Products

A-3655A

ELECTRIC UTILITY METHODS

E u m

FEATURE SECTION

BOOM SPRAY is among the newer methods of ridding the R/W of undesirable growths

BUSH-AND-BOG HARROW leaves brush roots permanently displaced

Right-of-Way Clearing Technique

Spraying and mowing are adapted by Carolina P&L to fit different terrains and use of helicopter is now on increase

H. O. DRENNAN, Right-of-Way Clearing Supervisor, Carolina Power & Light Co, Raleigh, N.C.

Flexibility in the selection of methods and equipment for clearing right-of-way at Carolina Power & Light Co—rather than settling on a single approach such as harrowing, mowing or spraying—has resulted in effective and economical R/W brush control. Furthermore, custom mixtures now used in helicopter spraying effectively prevent contamination of crops growing just off R/W.

Experiments with new and variations of older ways of clearing R/W continue at Carolina P&L in a constant effort to improve results and costs. Differences in terrain preclude the use of any one technique, so that the company makes use of many. These include bush-and-bog harrow equipment with a crawler tractor; mowing machines; and, spraying from: an adjustable-nozzle boom-type sprayer; a tank truck and/or marsh buggy equipped with long feed hoses; a jeep-powered sprayer; or a helicopter.

Bush-and-Bog Harrow Is First Choice

Factors of accessibility, type of brush, availability of equipment, cost, etc. determine the method of control to be used. The bush-and-bog harrow clearing method, required every six years for effective control, is the most economical—all other factors being equal. Its cost per acre, prorated on a yearly basis, is about $7.50. Mowing, required every three years, averages out to about $13 per acre, each year. Boom-spraying, required every three years, costs about $17 per acre per year. Helicopter spraying, required every two years, averages about $18 per acre, each year. Marsh-buggy spraying, with extended spray hoses, averages out to about $100 per acre each year.

Where heavy equipment can travel over the R/W, the choice of clearing methods depends on the results desired and the equipment available. A bush-and-bog harrow unit or a rotary brush-cutting mowing machine is usually selected to do the job.

The bush-and-bog unit has ten discs, 28 in. in dia, and is pulled by a crawler tractor. It clears at a cost averaging $45 per acre and the process must be repeated on a 6-year cycle. This compares well with the mowing cost of $35 to $40 per acre repeated at 3-year intervals. Harrowing also achieves added advantages—it provides effective fire-break lines and enables farmers to use the right-of-way for pasturage or row crops, thereby inhibiting brush regrowth. The basic disadvantage of the bush-and-bog unit is that it loosens the soil, thereby making it difficult for trucks to drive down the R/W. It takes two years for the soil, grass, and weeds to become compacted again.

The rotary mower grinds up the brush and spreads it on the R/W, leaving the soil firm and passable for line-maintenance equipment soon after the clearing.

Today, where the bush axe must still be used, stumps are treated with 16 lb of 2,4,5-T ester in 96 gal of No. 2 fuel oil. This minimizes resprouting.

Spraying Requires Proper Mixture for Environs

Spray control of R/W is effective if the particular type of spray mixture is selected on the basis of the particular specie of brush growth; and, if the controlled spray achieves the required density of penetration.

Boom truck, marsh-buggy extended hose, helicopter, and powered-jeep are the basic types of spraying equipment used by Carolina P&L for R/W clearing.

The boom-type sprayer is a new method of brush control. Its chemical mixture is tanked on a four-wheel-drive truck. The spray-nozzles on the back of the truck are calibrated and directed to cover a fixed portion of the right-of-way. When spraying, the truck is driven, at a fixed distance from the R/W edge, at a fixed speed of 2-3 mph—depending on the terrain. Nozzles are set to cover the right-of-way in one or two passes of the truck, the setting depending on the width of the R/W.

A standard formulation used in beam-spraying consists of 6 lb of 2,4,5-T ester, 10 gal of oil, and water to form 100 gal of mixture. Nozzles are calibrated to

SPRAYING from a helicopter reaches hard-to-get-at spots along the R/W

DRAG HOSE SPRAYING is employed where heavy equipment cannot travel on the R/W

R/W, cleared by bush-and-bog, provides excellent firebreak

Is Suited to Particular Locale

supply 60 to 85 gal of mixture per acre. The average cost, $50 per acre, compares favorably with mowing but does not remove brush from the right-of-way. The control, however, is quite effective on brush up to 4 ft high.

Near coastal swamps, where heavy mowing equipment cannot move, the R/W is sprayed using a truck or "swamp buggy." The vehicle maneuvers as close to the job as road and field soil allow. A drag hose is then used to spray the chemical mixture onto the swamp R/W. In some places, as much as 1½ miles of hose are used. The mixture for extruded hose spraying, 6 lb of 2,4,5-T amine in water to make 100 gal of mixture, is applied at the rate of about 300 gal per acre, depending on the density and height of the brush.

Helicopter Spraying Has Improved

Helicopter spraying has been used for the past three years, chiefly in the mountains, to provide access to terrain where the other methods are handicapped. It has also been used in a limited way in swampy areas, and present plans call for expanding this use.

The effectiveness of helicopter spraying has improved steadily. However, if wind direction and force are adverse during spraying, the chemical can drift and settle on trees, bushes, and crops outside the right-of-way boundaries. This problem has been solved in most instances through the use of two formulations developed by chemical producers and applicators. One is an "invert" material; the other an ester concentrate, containing a nonphytotoxic horticultural base oil with water as a carrier. While the oil-water solution is applied from a boom in front of the helicopter, the invert acid concentrate, mixed with water, forms a thick solution which is sprayed by a revolving disc or by nozzles under the helicopter.

Both formulations can be applied from great heights, the drift being negligible. Carolina P&L received only one "drift" complaint in 1959, none in 1960.

Another measure that improved the results of helicopter spraying was an increase of active chemical in the solution per acre. In 1959, 4 lb of acid in 10 gal of mixture—$50 per acre. In 1960, 6 lb of acid in 6 gal of mixture was applied to an acre of brush at $6 per gal—$36 per acre. The extra 2 lb of acid per acre was much more effective especially on brush 12 to 14 ft high. The achieved reduction in cost per acre was brought about by cutting down on the flying time required. Hard-to-kill species, such as pine, maple, and ash, however, continue to resist helicopter spraying to a degree.

The advantage of helicopter spraying lies in the ease with which difficult terrain is made accessible. The $36-per-acre per two-year cost compares favorably with the lower cost control methods, even in areas readily accessible to heavy ground equipment.

Specific Problems Required Custom Answers

The basic disadvantage of helicopter spraying is that it leaves standing brush, and spraying must be repeated every two years. Also, "browning" of brush foliage after a summer spray application results in adverse public reaction. Browning is currently being eliminated, particularly where lines go through residential areas, with a winter program of brush-stem broadcast-application. The mixture is broadcast-sprayed by the maintenance worker over the lower three-quarters of the plant with a good runoff to the ground around the root collar. This broadcast-application spray is achieved from a small power sprayer mounted on a jeep—the supply tank following on a tank trailer. With this spray method, the foliage drops at staggered intervals without a noticeable browning.

For such spraying of dormant vegetation, 8 lb of 2,4,5-T ester are mixed with No. 2 fuel oil to make 100 gal of solution. Results have been highly satisfactory, although the cost is higher than that of older methods.

A stand of grass growing up after a chemical spray has been applied occasions the hazard of grass-fire damage to pole structures. To prevent this, the grass-soil is generally sterilized on a 10-ft radius around poles with an application of granular or pellet chemicals herbicides.

Pine, hard to kill by spraying, succumbs to 6 lb of 2,4,5-T ester, 10 gal of fuel oil, mixed with water to make 100 gal of mixture. An amine 2,4,5-T solution has been found effective on ash and other hardwoods for use where pine is not growing.

Air Panels Keep ¼-in.x0 Coal Moving in Bunker

RAYMOND J. BRANDON, Engineer-Mechanical Production Dept, Detroit Edison Co, Detroit, Mich.

Inflatable neoprene panels not only have solved the operating problems associated with interrupted coal flow, but also have eliminated the expense and danger inherent in manually clearing hot coal from bunkers at the St. Clair Power Plant of Detroit Edison Co. Inspection of panels in the plant's seven bunkers after more than a year of service shows them to be in excellent condition. Future continuous operation will give a better indication of service life to be obtained.

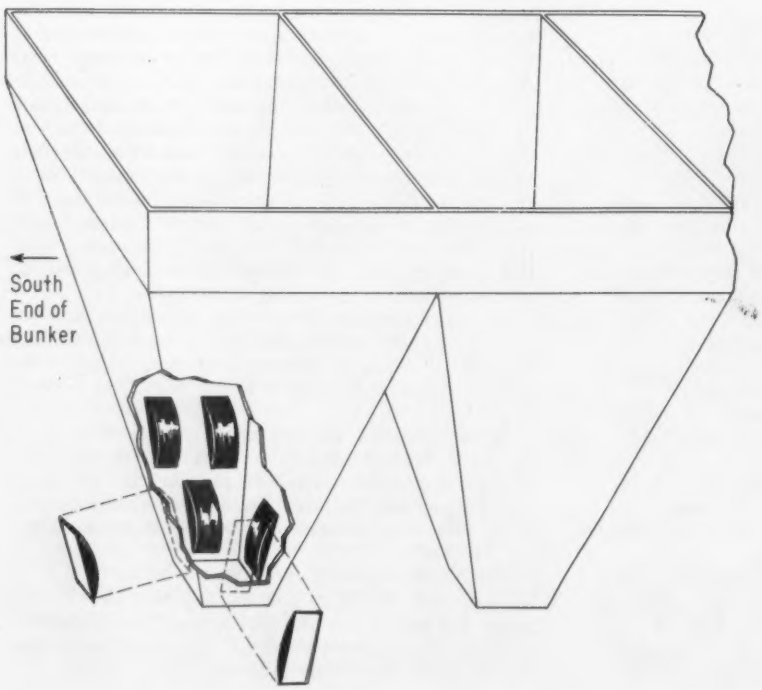
The common problem of sticking, hanging-up and rat-holing of coal in boiler bunkers has been encountered in the past in plants of Detroit Edison. Through changes in bunker design, discontinuation of the use of gunnite on bottom slope sheets, and use of stainless steel plates in corners to increase the valley angle, trouble with coal flow in the bunkers had been practically eliminated for 1-in.x0 coal.

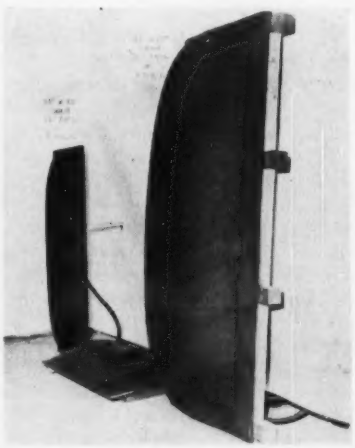
These improvements did not prove successful, however, in the coal bunkers for No. 5 boiler at St. Clair Plant when handling ¼-in.x0 coal prepared for cyclone firing. Serious operating difficulties were encountered with rat-holing occurring from the drag feeder to the top of the bunker, resulting in loss of coal feed to the cyclones. Also, heating of the coal occurred, requiring manual clearing of the bunkers weekly. These troubles, being encountered with fairly dry coal, had to be corrected before attempting to operate the boiler on stock coal with a much higher moisture content.

Initially, heavy-duty vibrators were installed on the bottom slope sheets of the bunkers. Coal flow was not improved sufficiently, however, to indicate trouble-free operation with stock coal. The next step was investigation of inflatable neoprene "Pneu Bin" panels, made by Gerotor May Co. As a first step, six panels were installed on the slope sheets of one of the seven bunkers.

Although some improvement in coal flow was obtained, neither plant personnel nor the vendor was satisfied with the results. The six panels then were rearranged as shown in the illustration. Operating conditions were improved to such an extent that after about a month panels were installed in the other six bunkers. Panels are programmed for continuous sequential operation but are interlocked with the drag feeder below each bunker to prevent panel operation if the drag feeder is not operating.

Satisfactory handling of stock coal in the bunkers during a winter period proved the value of the panels. Although they do not eliminate all rat-holing in the bunkers, in most cases they move coal into the void before feed to the cyclones is lost. Feed to a cyclone has been lost at times, but it has occurred so infrequently that it is not now considered an operating problem. Since the installation, there has been no evidence of coal heating, an indication the panels have kept coal moving in the bunkers.





Small inflatable panel (24x72 in.) has inflating amplitude of 14 in. at 5 psi; large unit (36x96 in.) has inflating amplitude of 20 in. at 4 psi

CIRCLE 23 ON READER SERVICE CARD

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Incipient Transformer Faults Quickly Detected

J. W. GORE JR, Asst Superintendent,
M. B. GORDON, Senior Engineer,
E. C. REICHERT, Asst Engineer, Electric Test Dept, Baltimore Gas & Electric Co, Baltimore, Md.

A commercial instrument has been adapted by the Baltimore Gas & Electric Co to detect incipient faults in power transformers by analyzing flammable gas concentrations in nitrogen blankets above the transformer oil. The device, a Mine Safety Appliance Co Model 40 Dual Scale Portable Gas Indicator, provides savings by discovering incipient faults before they reach the stage of actual failures requiring extensive repairs and loss of service.

The instrument measures the change in resistance of a calibrated platinum element due to the change in temperature caused by burning of combustible gas on its surface in the presence of oxygen. A Wheatstone Bridge circuit is used, and the change of resistance of the element exposed to the sample is balanced against another element not so exposed.

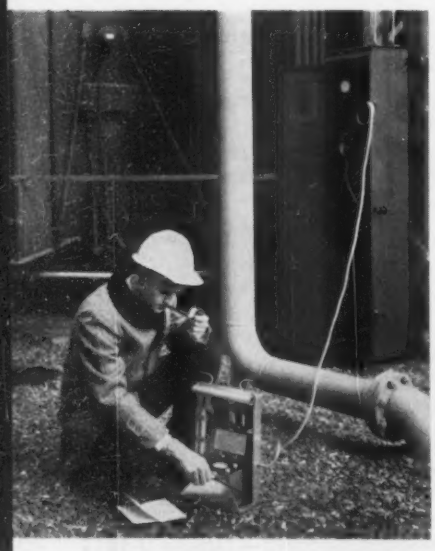
Meter readings are given in percent of the lower explosive limit of combustible gas or vapor in air. The meter is provided with two scales, one 0-100% LEL and the other 0-10% LEL full scale. A selector switch permits quick changing of scales. The basic calibration of the standard instrument is with pentane. However, the calibration is checked with methane gas, and results are expressed as an equivalent percent of methane.

As the instrument requires oxygen in the gas sample and as there is not enough oxygen present in the nitrogen blanket, the sampled gas is diluted with air. The developed apparatus consists of the gas indicator, two flow meters, a drying tube filled with activated aluminum and necessary tubing, fittings and sampling hoses.

The gas sample is drawn through one flow meter at a rate of 1.25 cu ft per hr. This flow is regulated with an adjusting valve which is part of the flow meter. Outside air is drawn through the drying tube and the other flow meter at the same rate. The two gas streams are joined and drawn into the indicator through a 5-ft length of humidity-conditioning sampling hose provided with the gas indicator.

The drier for the outside air and the sampling line compensate for humidity effects on the meter reading, particularly in the 0 to 10% range. The aluminum housing for the apparatus was fabricated by Baltimore G&E.

Any transformer with positive pressure on the nitrogen blanket may be tested. Sealed transformers operating under a negative pressure may also be tested by using a small air pump to draw a sample at the reduced pressure.



Combustible gas content of 80-Mva generator transformer is checked with combustible gas analyzer

Test Procedure Is Simple

A step-by-step procedure for field use is:

1. Check nitrogen transformer pressure gauge to be sure that a positive pressure exists. Do not attempt to draw a sample unless positive pressure exists.
2. Turn on and adjust gas indicator according to its instructions.
3. Connect sampling line to nitrogen system sampling valve and open valve to purge line.
4. After 10 or 15 sec, connect sampling line to fitting on combustible gas measuring apparatus.
5. With gas indicator selector set on 100% LEL scale take a reading. If reading is below 10% LEL, switch to 10% LEL scale and retake reading.
6. Multiply reading by conversion factor given on tag of instrument to obtain percent combustible gas content expressed as methane.
7. If converted reading is above 5%, call in the results immediately.

Test Pays-off in Practice

A serious incipient fault has already been uncovered during a program of measuring combustible gas content of nitrogen blankets in the largest power transformers on the system during the summer of 1960. The initial survey showed combustible gas contents ranging from 0.1% to 0.4% for all transformers measured except two.

The first transformer with high gas detector readings was one phase of a 48.75-Mva, 110-13.2-kv, 3-phase bank used for power interchange purposes. In August, 1960, the detector reading was 0.7%. In December it had risen to 6.0%. It was decided to disconnect the transformer promptly and connect a de-energized spare in its place.

Standard electrical field tests were applied to the transformer to determine if there was an insulation breakdown that could have caused the high gas content. Turn-ratio, 1,000-v Megger, and winding power factor tests failed to reveal abnormal condition.

After the oil was lowered to just above the core and coils, a defective no-load tap changer switch in the secondary winding was discovered. A mass of carbonized oil surrounded the tap changer contacts, giving evidence of intensive heating and increased contact resistance. From the condition of the tap changer and the high combustible gas content,

(Continued on page 83)

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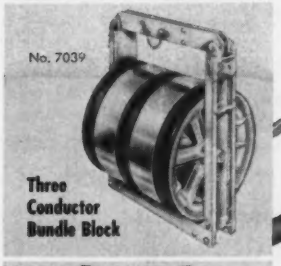

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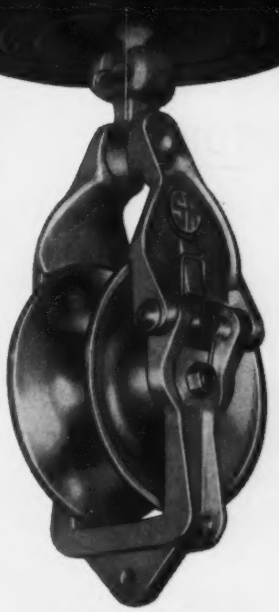
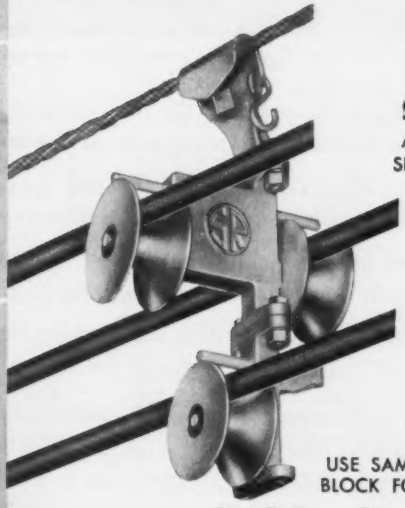


In Suspension



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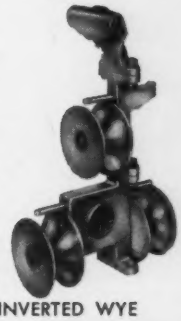

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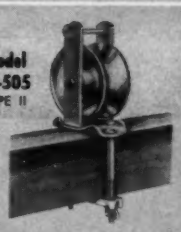
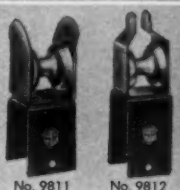


7" O.D. Sheave with anti-friction ball bearings mounted in steel frame.



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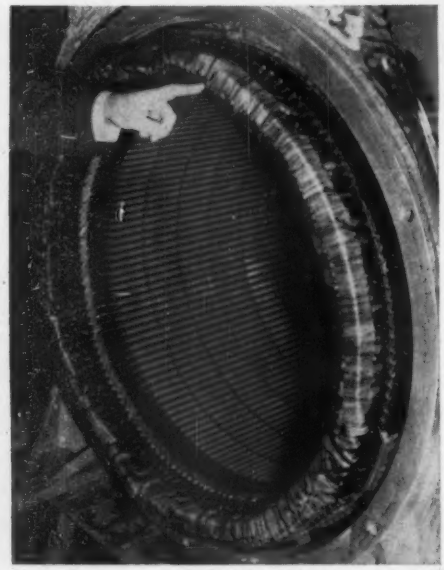
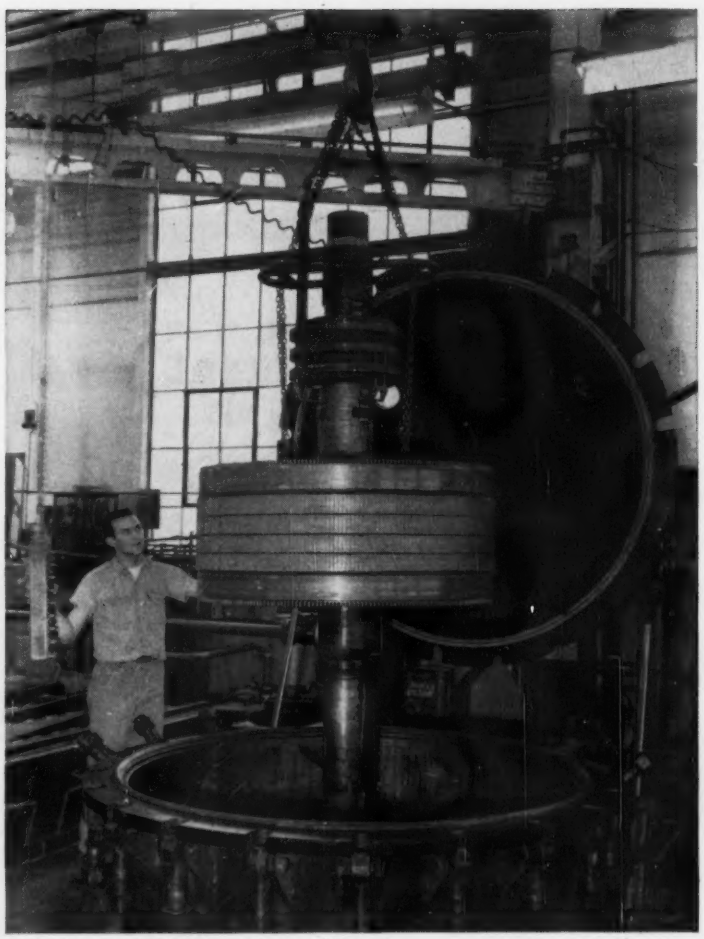


Complete stator assembly with NECCOBOND insulation system, after vacuum impregnation with Epoxy resins.



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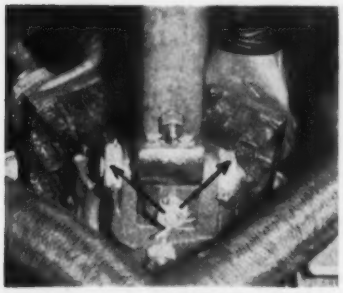
it appeared that an in-service failure of the bank was imminent.

The other high reading in the initial survey, 1.8%, was obtained on an 80-Mva, 3-phase generator transformer. This reading did not seem high enough to warrant immediate action, so periodic checks were ordered. Over the following several months, readings decreased to 0.2%. It is suspected that a self-healing fault had been experienced and the danger has passed. However, periodic checks of this transformer are still being made.

Under consideration is a technique for measuring the quantity of flammable gases dissolved in transformer insulating oil, because an incipient fault under oil would first give evidence through dissolved gases in the oil. The technique, which has been used to a limited extent, involves admitting oil into an evacuated container and then measuring combustible gases released. Readings obtained in this manner seem to bear a relationship to the gas content of the nitrogen in the transformer from which the oil was obtained. Such a procedure is required for those sealed transformers which have no gas space.

The authors were led to the development of the analyzer by earlier work done jointly by American Elecric Power Service Corp and Pennsylvania Transformer Div, McGraw-Edison Co. That work has since been enlarged upon and published.[1]

[1] "Detection of Incipient Faults in Transformers by Gas Analysis," P. S. Pugh and H. H. Wagner, AIEE Transactions No. 61-59.



Defective transformer no-load tap changer in one phase of 48.75-Mva 3-phase bank was uncovered by gas analysis. Arrows point to the two carbonized tap-changer contacts

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CIRCLE 24 ON READER SERVICE CARD

CIRCLE 83 ON READER SERVICE CARD

Night Survey Speeds Routing Through Wooded Areas

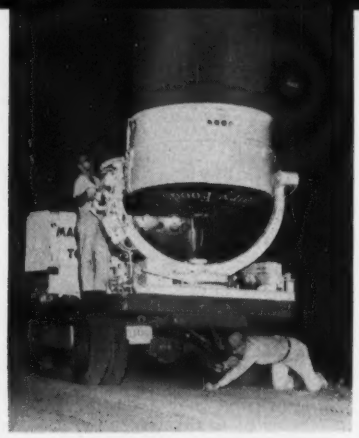
DEAN PALMER, Design Specialist, Kansas G&E Co, Wichita, Kan.

Using a searchlight and surveying at night can greatly simplify routing of transmission line right-of-way and construction, particularly when long distances and hilly or wooded areas are involved. Using this method, a Kansas Gas & Electric Co survey crew covered a nine-mile, cross-country diagonal passing through three heavily-wooded areas, a shelterbelt of trees and 20 tall hedge rows. Total time to make the survey was 3 hr. Cost of the searchlight, truck and operator was only $25.

Before starting, control points were located on aerial maps. Two crews then moved into position before dark, the searchlight over one point, the transit at the other. When it was completely dark, the light was turned on, shining vertically above control point.

Nine miles away, the surveyor fixed his transit on the beam. The truck-mounted light then was moved to the next crossroad toward the transit and directed in line by two-way radio. With the light in the proper location, a stake was driven directly beneath it and the truck moved on. Although the crew covered only nine miles, the diagonal route crossed 12 roads and required 14 stakes in a direct line, many less than a mile apart.

Weather can effect how far the light can be seen, but the method probably can be used effectively up to 20 miles. When operating near a large city, transit should be aimed away from town so the searchlight's beam will not be lost in the glare of city lights in the night sky.



STAKE is driven beneath searchlight used for night-time surveying

SURVEYOR sights on beam nine miles away—surveying at night

Crib House Bedrocked With 'Sand Island' Technique

F. M. MARTIN, Project Engineer, Cincinnati G&E Co, Cincinnati 1

Cincinnati Gas & Electric Co engineers are saving time and money by using the "sand island" method to sink a 59-ft-dia, 3,609-ton, steel crib house into the Ohio River bottom at the Walter C. Beckjord Station, near New Richmond, Ohio.

Specifically, CG&E began its project by laying out on the sand an 8½-ton steel ring with wedge-shaped cutting edge at the bottom. The concrete forms are built atop the ring and filled. After the first section hardens another is built atop the first and as the weight builds up, sand is dredged from the middle of the area—in this case a 59-ft-dia circle—and the structure begins to sink, pushing the sand it displaces up the center of the ring. The process is repeated until the crib-house structure lands on bedrock.

After all the sand is removed, divers are sent down to clear the bottom of loose rocks, timbers and any other debris.

Concrete is poured through a funnel device having a long spout directly to the very bottom of the crib-house structure, displacing water as it builds up and acting as a plug to keep the water out. The remaining water is pumped out and the edges caulked to stop seepage.

When completed the crib house will contain the big pumps supplying condensing water for the station's new fifth and future sixth generating units.

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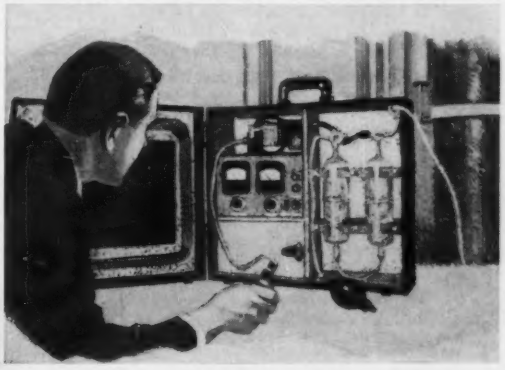
Low energy faults—insidious minute arcing or local heating—produce many combustible gases by decomposition of oil and solid insulation. These accumulate and mix with the nitrogen above the oil of transformers and regulators.

Pennsylvania's new Fault-Gas Detector recognizes these undeveloped faults, allowing the condition to be checked while the equipment is in service, carrying load.

Faults usually exist in an incipient stage for weeks or months before developing into major failures. When faults are detected, you can select the time and circumstances for an outage to make inspection or repair.

The accuracy and effectiveness of the Pennsylvania Fault-Gas Detector, used as a preventive maintenance tool, has been proved with prototype instruments by the analysis of gas samples from over 300 transformers in service. Incipient fault conditions found in eight transformers produced by several manufacturers were corrected before total failure and serious damage occurred.

Pennsylvania's Fault-Gas Detector can protect your service. Make its application a part of your routine preventive maintenance program. An entire test set, complete with instructions, can be purchased for only $435.00. For further information on incipient fault detection, contact the Service Department, Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.



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INSTRUMENTS

CORONA TEST EQUIPMENT

. . . for tests on electrical insulating materials, individual insulation structures and insulation of electrical equipment like cables, transformers, switchgear, rotating machinery, capacitors, bushings and communication apparatus . . . for measuring corona starting and extinction voltage, apparent corona charge, relative corona current. Your inquiries for special applications are invited.

WRITE FOR BULLETIN 66-W

B108

JAMES G. BIDDLE CO.
Electrical and Speed Measuring Instruments
1316 ARCH STREET, PHILADELPHIA 7, PA.

CIRCLE 36 ON READER SERVICE CARD

Pest birds build nests in substation transformers, insulators and radiators where, when nests become wet, "shorts" can cause costly damage to equipment and loss of valuable customer good will. Cleaning up after the birds is no fun.

Let Rid-A-Bird Help You

RID-A-BIRD is a simple, efficient system that insures permanent removal of pest birds from substations. No awkward, complicated devices or equipment to install. The Rid-A-Bird System is successfully at work for businesses throughout the nation. It will enable you to watch your pest bird problems fly away. Mail coupon today.

RID-A-BIRD INC., P. O. Box 22, Muscatine, Iowa Dept. EW-1
Send descriptive literature and prices.

NAME_____

ADDRESS_____

CITY_____ STATE_____

CAPACITOR POTHEAD (115-kv) is lowered onto pre-assembled buildup

Prefab Build-up for Potheads Cuts Cost

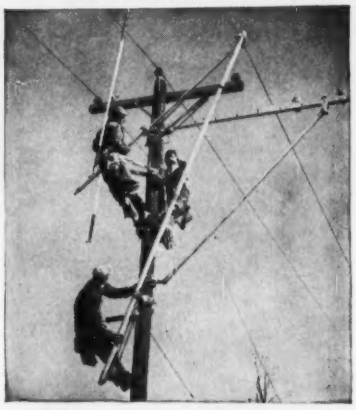
W. HAROLD JONES, Electrical Engineer, Sacramento Municipal Utility District

Incorporation of preassembled, capacitor-graded potheads to terminate 115-kv cables has resulted in substantial savings at Sacramento Municipal Utility District's new Station B. Initial cost was 13-20% less than prices quoted for older and more commonly used designs. Installation costs were also considerably reduced—three electricians and two men with a crane installed three potheads in 9 hr, the time normally required to install only one.

The preassembled "build-up" consists of the insulation and the stress cone which is spirally wound inside the insulation. Thus, all hand taping is held to a minimum. The capacitors, installed at the factory within the porcelain shell, are connected in series, between the pothead terminal and ground. The result is an even voltage gradient along the length of the pothead.

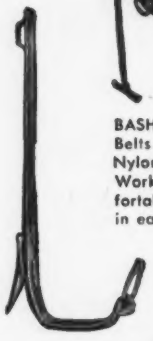
A power-factor tape is inserted in the circuit so that the capacitors can be disconnected from ground when measurements are required. The manufacturer recommends reading the capacitance of the potheads at certain time intervals. At Station B, satisfactory readings were obtained before and after assembly of the potheads.

Bashlin's Quality
FOR OVER 30 YEARS



TOOLS OF SAFETY . . .

BASHLIN Quality Body Belts with the additional Nylon Safety Feature . . . Work Safely . . . Comfortably . . . with tools in easy reach.



BASHLIN Quality Alcoa Aluminum Alloy Adjustable Climbers with replaceable gaffs . . . There is nothing better anywhere!

BASHLIN'S Nylon and leather Safety Straps . . . Bashlin Quality, of course.

You Can't Afford Anything LESS Than the BEST—
***Buy* BASHLIN**
Highest Quality For Over 30 Years
Distributors in Strategic Areas in U.S.A.
EXPORT: Copperweld Steel International Co.
IN CANADA: A. B. Chance Co. of Canada Ltd. Toronto

Ask for . . .
CATALOG NO. 456

W. M. BASHLIN CO.
GROVE CITY, PA.

CIRCLE 37 ON READER SERVICE CARD

'MOUSE', attached to pulling cable, is inserted in underground duct

'Mouse' Easily Rods Cable Through Duct

Today a "mouse" is rodding electrical underground cable at Consolidated Edison Co of New York, Inc, faster, with less aggravation, and more economically than when conventional methods were used.

Rodding electrical cable through ducts has for years been a frustrating, time-consuming, and costly task. Traditionally, these inches-wide, miles-long ducts were rodded with short wooden rods, threaded together and pushed the length of the tunnel. A threading wire attached to the last rod-length (retrieved from the far end of the duct) provided the cable crew with a means of hauling their pulling or winch cable through the duct.

The "mouse" is an electrically operated self-propelled device that scampers through underground ducts at 150 ft per min. Powered by a totally enclosed waterproof electric motor, the "mouse" achieves its motion from sturdy traction brushes attached to either end of the device. Constructed of V-shaped nickel alloy wires or "tines," the brushes pulsate or vibrate at the rate of 10,000 movements per minute. Once in contact with the duct wall, the tine movements create forward motion.

CIRCLE 26 ON READER SERVICE CARD

(More Construction on page 89)

FOUR PRINCIPLES FOR TRANSFORMER PAINTING

1. **Color.** There is a direct relationship between color and operating temperature. Subox paints are made in modern colors to meet *present-day peak load requirements.* They are available in standard grays, and also in decorator shades for color-styling in residential neighborhoods.
2. **Film Thickness.** When repeated coats of paint build up on a transformer they tend to act as a blanket and hold the heat in. With Subox paints, *fewer coats are needed* and internal heat is more efficiently dissipated.
3. **Film Structure.** Aluminum-containing paints are often desired because they reflect sunlight; however, in conventional paints of this type the aluminum flakes overlap and leaf together to form an insulating barrier. In our Subalox paints, the polished aluminum flakes are non-leafing and do not overlap. Therefore, they promote both reflection and better radiation.
4. **Long Life.** The paint on a transformer is subject to wide temperature changes. *All Subox paints contain suboxide of lead.* This unique pigment remains chemically active even after drying; builds a tough, fibrous film that maintains flexibility and does not crack, chip, peel or blister even under the most punishing conditions.

Leading electric utility companies use Subox paints for transformers. Write for color card and literature.

SUBOX PAINTS

Subox Inc.
Trade Mark

Main Office & Plant
3 Fairmount Park, Hackensack, N. J.
SALES ENGINEERS IN MOST MAJOR CITIES
Affiliated Plants: Canada, Mexico, England, Belgium, Switzerland, Austria, Australia, New Zealand.

CIRCLE 87 ON READER SERVICE CARD

B rush control

A rbor specialists

R ight-of-way clearance

T ree surveys

L ine clearance

E xperimental research

T ree trimming

T echnical consultation

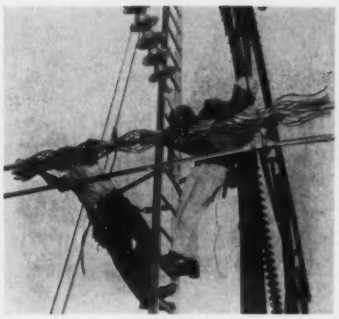
More than 13 years ago Bartlett successfully pioneered the use of the helicopter for shade tree spraying—an operation that was to lead the way, a few years later, to a new efficient method of control of woody plants along utility rights-of-way.

At first, difficult terrains presented unusual problems but gradually through research and experience, new equipment was developed and new herbicides and techniques perfected to overcome them. Today, Bartlett research in this important field is carried on continuously through college fellowships and at the Bartlett Research Laboratories.

If your right-of-way clearance, line trimming, brush control or tree survey requirements present a problem, we invite you to share our years of experience. This service is now available from Maine to Florida, and west to Illinois and Alabama.

BARTLETT TREE EXPERTS

Home Office, 2770 Summer Street, Stamford, Conn.
Research Laboratories and Experimental Grounds, Stamford, Conn.



Template Aids in Armor Rodding EHV Line

Handling and applying Armor-Grip Suspension rods overhead was simplified on the Pennsylvania Electric Co's 460-kv test line by the use of two neoprene discs and a piece of pipe.

The new technique permits the ground men to preassemble the AGS rod assembly and then hoist it up as a single component. Thus, the linemen do not have to handle the rods singly, and they can clip in the conductor much faster, easier, safer, with simpler rigging and less danger of scratching conductor or rods. The idea was suggested by Preformed Line Products Co, Cleveland, Ohio, and given field trial on Penelec's AGS installations by Day & Zimmerman.

The only tool used is a simple template made up of two rod holders, an AGS neoprene core, and a length of pipe. The holders are soft neoprene discs with a conductor-size hole in the center, and radial slots formed to retain the AGS rods in their proper relative position. One slot is cut through to the center hole so that the holder may be spread for removing the rod assembly from the pipe and later attaching it to the conductor. The neoprene AGS core is used as a centerline reference for positioning the rods longitudinally. When all the rods are secured in the slots, the holders are spread and the rod assembly separated from the pipe.

A hand line is attached and the rod assembly is hoisted as a single component.

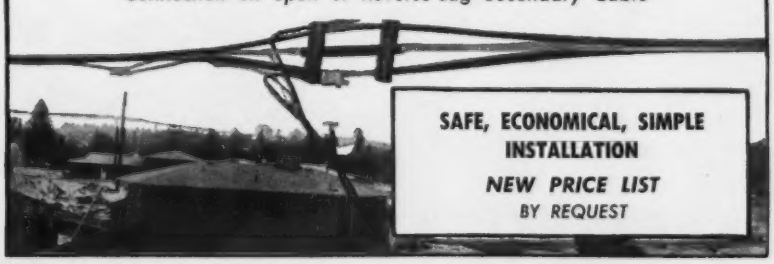
The clipping-in linemen spread the neoprene holders and position the rod assembly on the conductor, centering it with the AGS neoprene core. Then the aluminum housing is applied, the retaining strap secured, and the conductors are suspended from the insulators. At this point the rigging is removed and the rods are wrapped onto the conductor.

This method is well suited to EHV suspension assemblies involving large conductors.

CIRCLE 27 ON READER SERVICE CARD

MULTIPLEX SPREADER CO.
P.O. Box 163, Gresham, Oregon

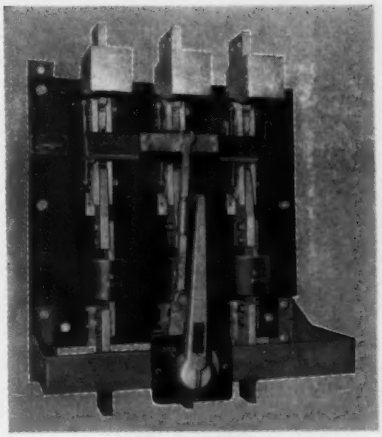
Manufacturer of the Only Practical Spacer for Midspan Connection on Spun or Reverse-Lag Secondary Cable



SAFE, ECONOMICAL, SIMPLE INSTALLATION

NEW PRICE LIST
BY REQUEST

CIRCLE 38 ON READER SERVICE CARD



THE NEW
BARKELEW

BOLT-LOC*

LOAD BREAK SERVICE ENTRANCE SWITCH

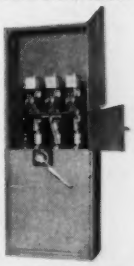
For 1200 to 4000 Amperes —240-480-600 Volts

Designed for use with HIC fuses for service entrance applications, and with or without fuses, as isolating switches, feeder disconnect or protector switches where cool operation, rugged construction, safety and complete reliability are required. Thoroughly tested for interrupting, short circuits, and load carrying capacity.

- Bolted pressure contacts.
- Quick break mechanism.
- Double slotted steel plate arc quenchers extinguish arc rapidly, usually in less than 1½ cycles.
- Replaceable arcing tips on all switches. Silver-tungsten tips on 480-600 volt switches.
- All parts made to close tolerances for positive operation.
- 14 inch depth to match standard control cabinets.
- Silver contacts and terminals.
- Fusible for: Bussmann KRP Hi-Caps, KTX Limitrons; Chase Shawmut 55H Amp-Traps; G-E Type CLF.

FREE STANDING ENCLOSURES

Available standard enclosures start at 32" wide by 14" deep by 76½" high. Minimum enclosure 30" wide.



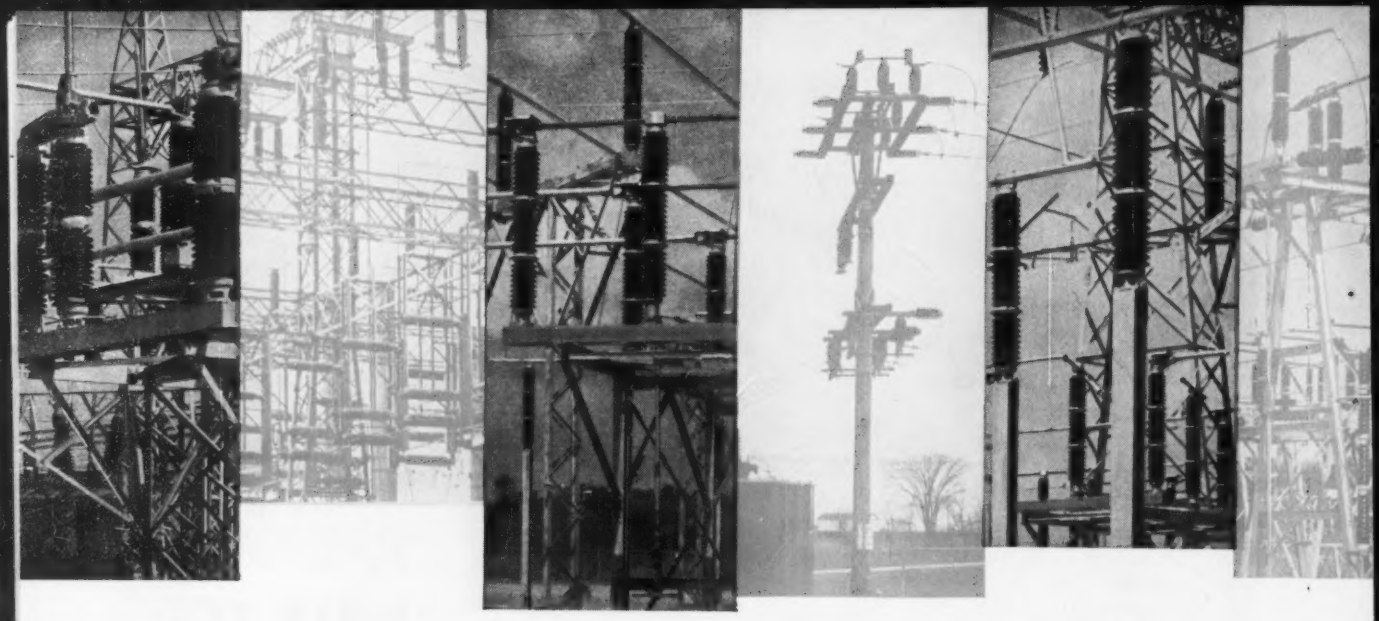
FOR COMPLETE DETAILS WRITE FOR
BULLETIN NO. 101

BARKELEW

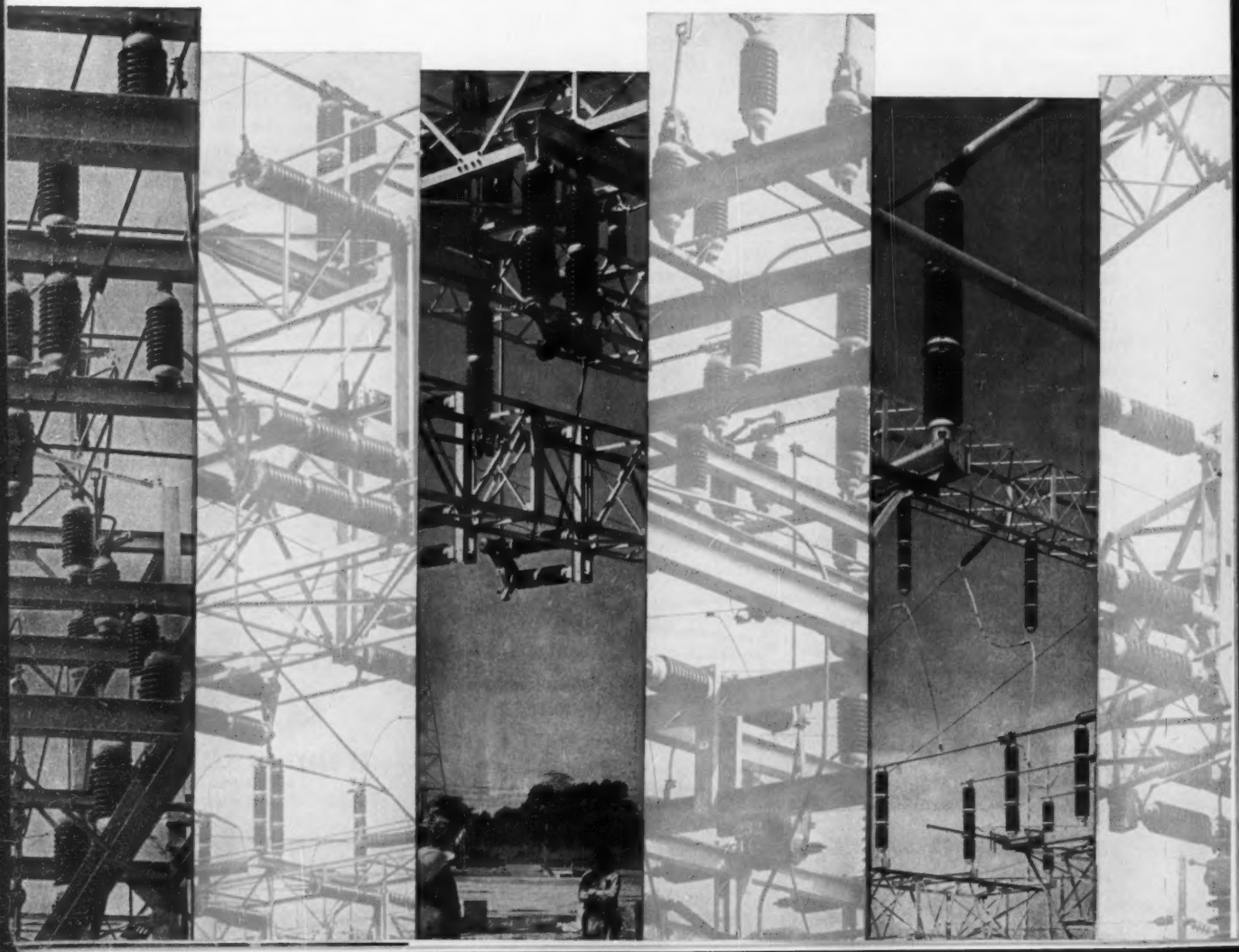
*Trade Mark

THE BARKELEW ELECTRIC MFG. CO.
Middletown, Ohio
Electric Switching Equipment Since 1904

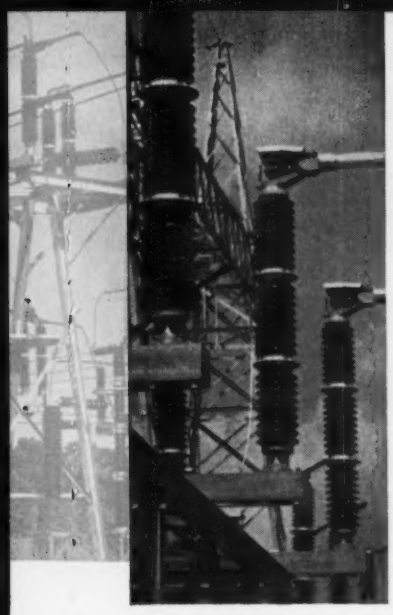
CIRCLE 89 ON READER SERVICE CARD



When you design with Lapp Station Posts.....



ELECTRIC
UTILITY



Voltage Rating kv	BIL, kv	Cantilever Strengths, lbs.		
7.5	95	2,000	4,000	8,000
15	110	2,000	4,000	8,000
23	150	2,000	4,000	8,000
34.5	200	2,000	4,000	8,000
46	250	2,000	4,000	8,000
69	350	1,500	4,000	6,000
115	550	1,700	2,900	4,000
138	650	1,450	2,450	3,900
161	750	1,200	2,000	3,500
	900	910	1,450	2,750
	1050	750	1,170	2,300
	1300		1,000	2,000
	1470		900	1,750
	1640		770	1,550
	1800		680	1,400

.....you can have what you want in BIL, in strength, in stiffness

Use of Lapp Station Posts frees designers of modern substations from the need to design around characteristics—and shortcomings—of conventional switch and bus insulators.

The family of Lapp Station Posts is a "modular series" which gives widest range of insulation levels *and* strength ratings. Station Posts are smaller in diameter, too . . . lighter in weight . . . stiffer . . . easier to assemble; and they're suited to mounting horizontally, underhung or angled . . . available in strengths greater than have ever been offered in conventional pin-cap units.

Stations on Lapp Station Posts require less real estate, less steel work. And, because their performance is better under all electrical conditions and mechanical loading, they need less maintenance too. You should have the whole story. You can read it in the new Lapp Catalog No. 8. If you haven't a copy, we'll be glad to send one.

Lapp Insulator Co., Inc., LeRoy, N. Y.

Lapp

CIRCLE 91 ON READER SERVICE CARD

ELECTRIC UTILITY METHODS

E u m

OPERATIONS & TESTING

Portable Oscillograph Analyzes

S. H. HOROWITZ, Assistant Relay Section Head, AEP Service Corp, New York

American Electric Power System's utilities are now achieving, with a minimum of time and labor, convenient, low-cost, on-the-spot analyses of electrical equipment operating characteristics by means of portable oscillographs, plus picture-in-a-minute camera backs.

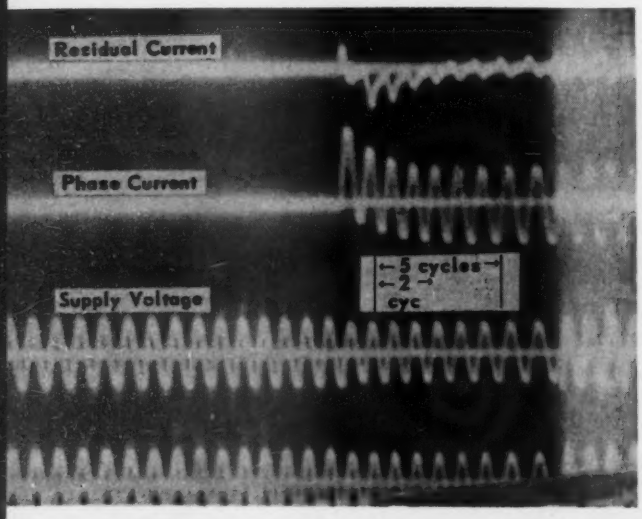
When portable oscillographs became available, it became possible to perform special tests on electrical equipment with no more men and equipment than a standard maintenance or checking crew and the electrical device to be tested. The General Electric Type PM-18 portable oscillograph used by AEP is a four-element electromagnetic recording instrument that uses an attached Polaroid Land camera to permit immediate study of the test film. This last feature has proved extremely valuable, since an analysis of each test can be completed before continuing. Corrective changes in either technique or procedure can then be made with very little lost time. A continuous drive is also available for phenomena lasting more than 40 cycles, but this uses conventional photographic film that requires developing. The PM-18 is entirely self-contained with built-in rheostats; it weighs only 30 lb and operates on 120-v ac.

A built-in switch is provided to initiate the test after manually starting the oscillograph. Very often it is desirable to start a sequence but delay recording until some predetermined point in the operation is reached. An auxiliary relay coil was added to the oscillographs to start the oscillograph automatically when this coil is energized.

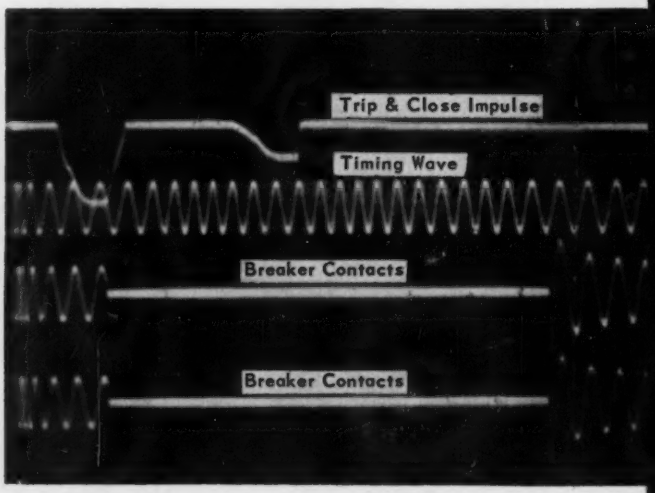
Since this convenient tool has become available for analysis, major apparatus of AEP is rarely put into service without its extensive use. A complete list of applications for the portable oscillograph would be too long to include here. Those that follow were selected at random to depict the many uses of, and some of the techniques involved in, oscillogram analyses.

Motor Startup Readily Analyzed

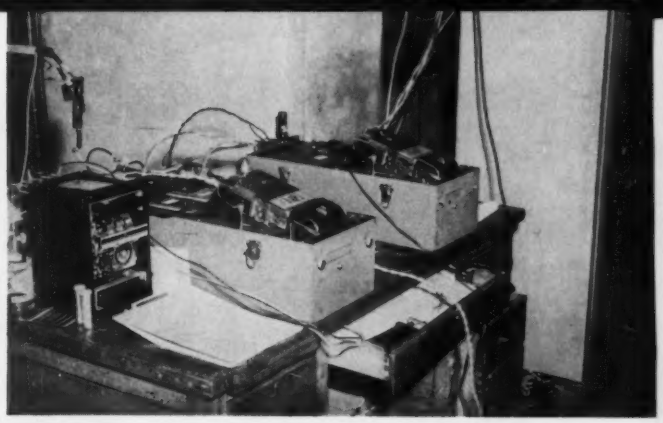
Transient currents present in starting a motor cannot be calculated to any degree of accuracy without complete design data. This data is rarely available, so phase relays protecting against short circuits have always been set by trial and error. In addition, the current transformers used to reduce the actual motor currents to safe and usable values



'PIC' shows that 5 and 2-sec delays introduced to ground and phase relays will provide better motor protection



SCOPE SHOT of high speed breaker reclose shows current waves disappear on "open"; reappear on "reclose"



PICTURE-A-MINUTE CAMERA, plus portable oscillograph, produces on-the-spot oscillograms for equipment analyses

Equipment Operation

are in themselves sources of error and produce current in the residual circuit although no fault exists in the motor. The relay intended to protect the motor against faults involving ground must be set above this error current even though it is an unpredictable value. Here, too, a trial and error setting was required.

The oscillogram (bottom left, page 92) indicates the magnitude and variation of residual and phase currents upon starting a 4,000-hp, 4-kv motor. Analysis shows that a five-cycle delay in the ground relay permits a much lower setting than would be possible with an instantaneously acting relay. If we could delay the phase relay by one or two cycles, this would lower its setting too, and thereby provide much more sensitive protection. Also of considerable interest is the noticeable reduction of supply voltage during the starting period.

ACB Operation Is Established

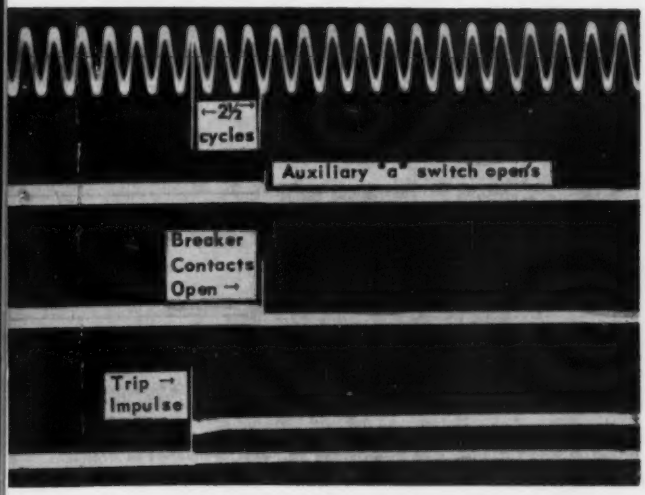
A complete analysis of the 4-kv air circuit breakers (ACB) used in power plant auxiliary motors enables better evaluation of the automatic transfer scheme. Knowledge of how long it takes to open and close its main contacts and the relation between main and auxiliary contacts is necessary if safe procedures are to be established.

The oscillograms (bottom right, page 92) shows sequence involved in opening and closing a 4-kv air circuit breaker. For the type of breaker tested, the main contacts open 2½ cycles after the trip impulse, with the auxiliary switch opening a fraction of a cycle earlier. Similarly, the breaker closes in 13½ cycles, the auxiliary contact having opened two cycles later.

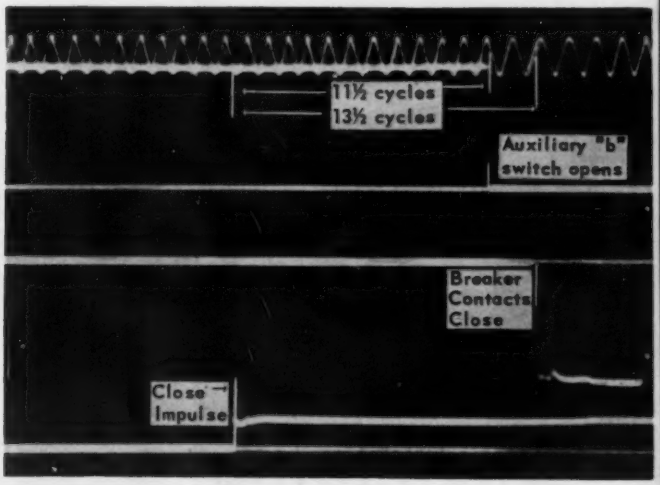
OCB Operation Studied

The last oscillograms show a high-speed reclose operation. The first offset on the top trace is the trip impulse and the second offset shows the close impulse. The current waves of the third and fourth traces disappear when the breaker contacts part and then reappear on the reclose.

Additional tests that are often performed now as a part of a routine maintenance or calibrating procedure are: the timing of pole closing on oil circuit breakers; the transfer during condenser operation from the starting to the running breaker; coordination of contacts involved in carrier current relaying; the determination of magnitude and waveshape of relay polarizing current; and the transfer of field discharge resistors on breaker operation.



DETERMINATION OF RELATIONSHIP between main and auxiliary contacts of a 4-kv motor's ACB, plus . . .

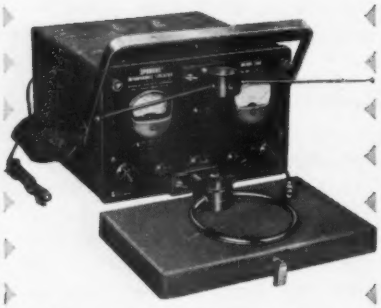


. . . knowledge of time it takes the ACB to open and close its contacts, make for much safer operating procedures

SPRAGUE®

MODEL 500 INTERFERENCE LOCATOR

LOCATE rf NOISE SOURCES QUICKLY



This versatile instrument is a highly sensitive interference locator—*with the widest frequency range of any standard available unit!* Model 500 tunes across the entire standard and FM broadcast, shortwave, and VHF-TV spectrums from 550 kc. to 220 mc. in 6 bands.

It's a compact, portable, rugged, versatile instrument—engineered and designed for most efficient operation *in practical field use.* It features a transistorized power supply, meter indications proportional to carrier strength as well as sensitivity of 5 microvolts minimum for 5% meter deflection over entire tuning range.

For full details, send for brochure IL-106.

SPRAGUE ELECTRIC COMPANY
315 Marshall Street, North Adams, Mass.

SPRAGUE®
THE MARK OF RELIABILITY

Tool Speeds Relay Installation

JAMES BERGMAN, Streetlight Maintenance Man, Wisconsin Public Service Corp, Green Bay, Wis.

Use of a hand-compression tool and fittings when installing or replacing relays on street-light installations means that the relays can be changed in about 15 min. It is estimated that this new idea will save about 100 manhours per year at Wisconsin Public Service Corp.

When installing or replacing the type of relay used by WPS, it is usually necessary to lengthen the leads. Previously this was done by using a split-bolt or lap-type connector. This not only required about 1 hr per installation but also resulted in a bulky, messy-looking job.

With the use of the Sta-Kon tool and compression connectors, made by Thomas & Betts Co, Inc, these leads can be lengthened quickly. The resulting job also presents a neat appearance.

CIRCLE 28 ON READER SERVICE CARD

SAVE SPACE with the K-T METER RACK

A meter rack specifically designed for storing all types of meters in normal Hydro use.

EASILY ADJUSTABLE HOOKS

Meters are securely held on both sides of rack and hooks can be adjusted by hand to any position. Special purpose hooks for other storage uses (i.e.—wire coils or shelves) can be supplied.

The simplicity and efficiency of this storage method greatly speeds sorting, despatch of meters, and saves floor space. Racks are shipped ready for use.

STANDARD RACK

Standard rack is 7 ft. high x 10 ft. long and will hold 196 meters in a floor space of only 10 ft. x 14 ins. They can be used in series or smaller units, mounted on castors to make movable handling racks. Standard finish is a hard-wearing aluminum paint.

AGENTS REQUIRED

KELVIN-THOMPSON CO. LTD. AJAX, ONTARIO, CANADA

Headphones Help in Relay Work

C. W. PETERSON, Sr, Relay Eng'r, Ohio Power Co, Newark, Ohio—AEP Systems

Headphones, now used at Ohio Power Co's Southern Division, permit close coordination of related work being simultaneously carried out at two separate locations. Headphones, unlike handsets, leave hands free for working.

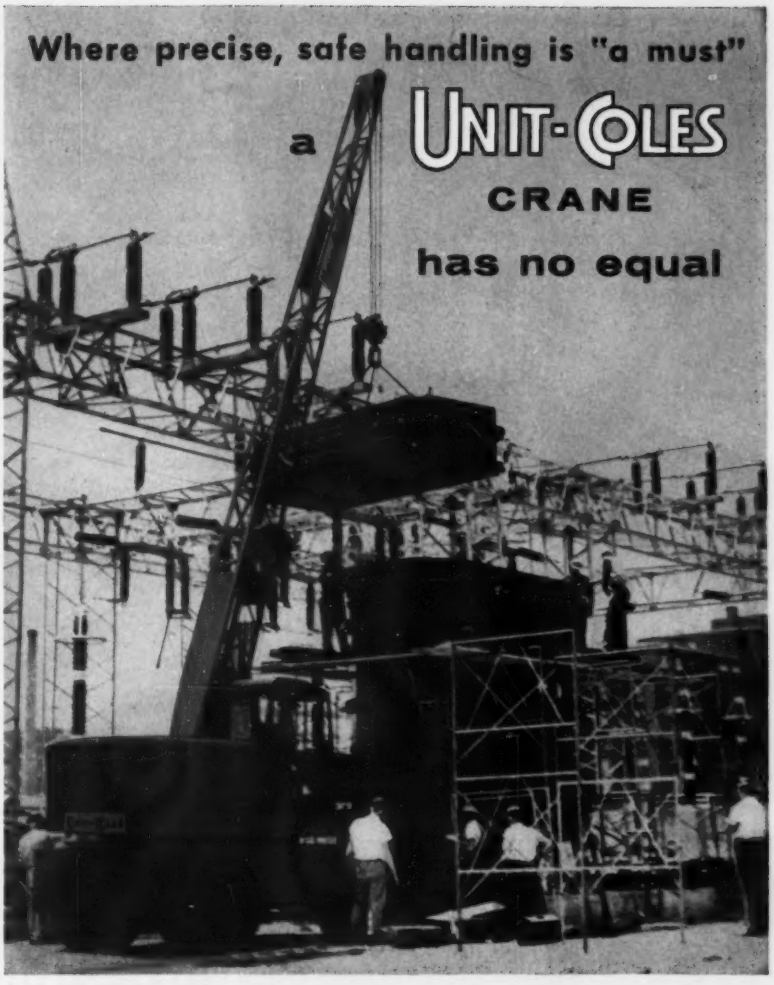
The headphones improve communication during relay and breaker adjustments, replacement of bushing current transformers, and other work. They permit closer coordination of work, such as checking wiring, between the man inside the building and the one outside in the station yard. One set serves the entire relay department and is carried from station to station as needed. Phones can be hooked up to spare conductors in the underground control cable or to any light telephone cable. Ohio Power's set saves about 40 manhr a year.

Window for Service

A drive-in window with two-way communication is the newest customer service at Central Louisiana Electric Co, Berwick, La.

It is now possible to make any type transaction from a car at the drive-in window. All the customer has to do is drive up, press a button for service, pay service bills or just get information.

Also recently in operation at the office is a night deposit chute so customers can make payments after closing hours. Pressing a handle produces a payment envelope.



■ Substation repair or renovation often involves handling expensive, damageable electrical components in energized areas. Because there is no margin for error, precise handling with safety is "a must". On both counts — accuracy and safety — a UNIT-COLES crane offers you unmatched advantages.

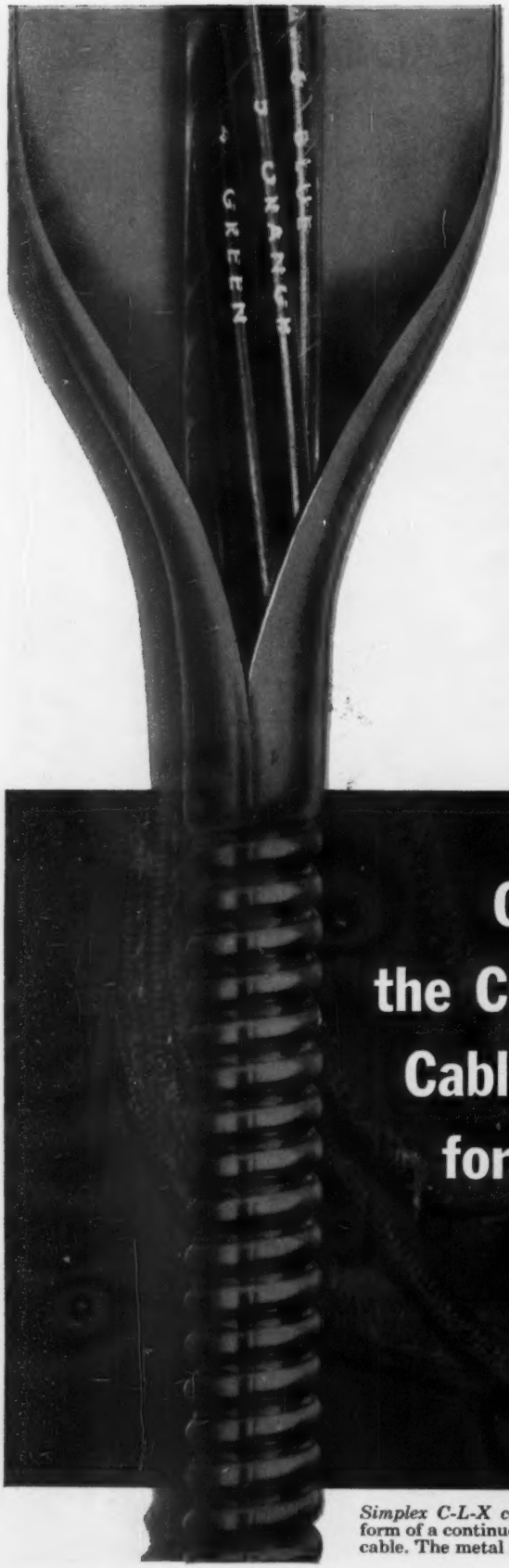
■ Generating its own power by means of an engine-generator unit, the UNIT-COLES crane is electrically controlled and operated. Individual electric motors provide fully independent or combination control of all crane motions. The crane operator has infinite speed control at his command. He can raise or *lower* a load at less than a foot per minute with pinpoint precision, or run "wide open" at speeds up to 150 f.p.m.

■ Utmost safety is assured by a positive-action Safe Load Controller with a "stop and hold" function that automatically prevents overloading. Easily adjustable limit switches, by prohibiting dangerous over-travel, assure that load and boom avoid nearby "hot" lines. These outstanding safety features together with "fail-safe" *automatic braking* and "*dead-man control*" on all crane motions make a UNIT-COLES *the world's safest crane.*

■ UNIT-COLES cranes, self-propelled or truck-mounted, are available in capacities ranging from 5 to 55 tons. Why not take a tip from the scores of electric companies who have already found *this crane* to be *the perfect answer* to their handling needs? Write today for full details!

UNIT-COLES
THE WORLD'S SAFEST CRANE

UNIT CRANE & SHOVEL CORP.
6711 West Burnham Street
Milwaukee 19, Wisconsin



The cable you see here is *not* interlocked armor. It is Simplex' new C-L-X . . . the completely sealed cable system.

- Completely sealed against liquids and gases.
- Protected against mechanical damage by a continuous, corrugated metallic sheath.
- As pliable as unsheathed cable because of its corrugated design.
- Needs no separate duct or conduit in any environment.
- Nonferrous sheaths can be designed to function as grounds or shielding.

Simplex C-L-X is impervious to liquids and gases, is resistant to all forms of mechanical damage, and is as pliable as unsheathed cable.

Available with sheaths of steel, aluminum, copper or bronze, and with or without outer plastic jacketing, Simplex C-L-X provides the ideal solution for almost any installation, particularly those in which cable life is limited by severe ambient conditions.

Write today for illustrated brochure containing application and engineering information.

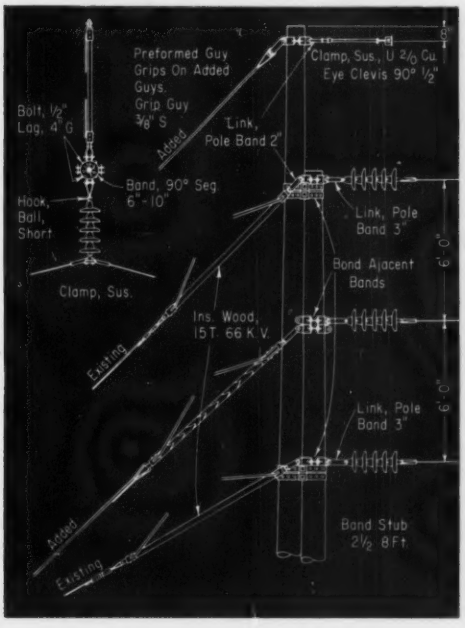
Simplex

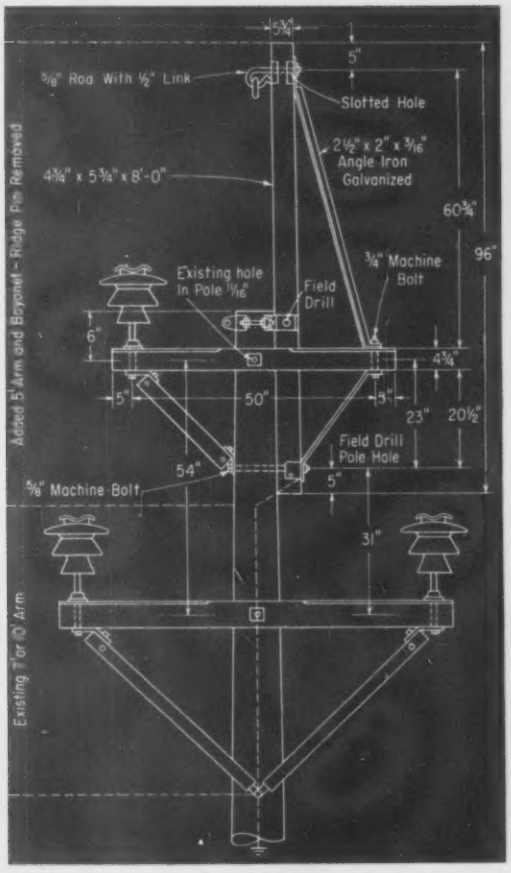
WIRE & CABLE CO.

Cambridge, Mass. • Newington, N. H.

Only Simplex C-L-X . . . the Completely Sealed Cable System . . . is Built for Torturous Conditions Like This

Simplex C-L-X combines cable and duct in one integrated system. Metal, in the form of a continuous flat strip, is formed into a welded tube around the insulated cable. The metal tube is then corrugated to form Simplex C-L-X.





Pole-Top Changes Cut Reconductoring Costs

DEAN MILLER, Transmission Engineer, Electrical Engineering Division, Engineering Department, Electrical Division, Public Service Co of Colorado, Denver, Colo.

A wood bayonet to support the ground wire and a 5-ft-MV arm to support the ridge phase provided solutions to Public Service Co of Colorado's problem of economically adding an overhead ground wire on lines between the Cameo Steam Plant and Grand Junction Substation. This simple addition to present structures enabled two linemen and one groundman to install 14 to 16 bayonet additions per day, or approximately two per hr.

New plant location and load growth in the area necessitated reconductoring of this particular 21-mile stretch of 69-kv line on poles having a triangular configuration using 7-ft-MV arms and 28-in. steel ridge pins. All other lines out of Grand Junction and the Cameo Plant had overhead ground wire and good operating records, but this length of line had been troublesome due to lack of lightning protection.

Because this addition was made on structures already present, the crossarm and bayonet had to be designed so that installation would be obtained with minimum effort and drilling. The original ridge pins had been installed with the top through-bolt 6 in. below the pole top. This hole is used for the crossarm through-bolt and the 4¾ x 5¾ x 8-in. wood bayonet is supported at the pole top by a three-piece band which clamps the top of the pole above the new arm. Metal angle iron braces were used to ground the static wire attachments to the new ground wire and add stability to the bayonet itself. Because of the difference in the framing of the original fixtures, two holes are field drilled—one in the pole for the crossarm brace's through-bolt below the 5-ft arm and one in the bayonet for the pole-band attachment.

The new downwire is added to the poles on a quarter face of the pole and attached to the angle iron brace by means of a grounding clip. A ground rod is driven at each pole and a moulding added to protect men and animals from lightning static discharges.

To facilitate the addition of the static wire on vertical and three-pole corners, a 10-ft higher pole is banded to the present pole on the quarter face and set 2 ft in the ground to support the butt and prevent it from moving. Guys were added to the middle phase of the conductor attachments and to the new static position.

(More Maintenance on page 100)

Precision

How Precision's exclusive qualities make multiple lighting control **99% fail-proof**

This engineer uses a jeweler's glass for his final inspection of every Precision photocontrol. Other Precision engineers use ageing chambers, comparators, endurance and hardness testers, oscilloscopes and weatherometers — plus devices originated by Precision for "breakdown" testing of lighting controls — to insure Precision performance at sixteen separate quality control points in our labs.

It is their attention to perfection that makes Precision photocontrols so nearly fail-proof that Precision-equipped multiple lighting systems need only 1% controls replacement in any given year. That is a fact, proved on the lines of major utilities a half million times every day. This perfection results from built-in Precision distinctions that set this control apart from all complex, old-style photocontrols.

Superior materials

Precision uses the industry's largest gold electrode cadmium sulfide cell and gives it total area exposure since both shading and shielding reduce the efficiency of any photocell. Precision makes and uses the only bimetal switch metallurgically-balanced specifically for lighting control. Then Precision adds special pre-fabrication techniques possible only in the world's largest laboratory devoted entirely to multiple lighting controls: measured-atmosphere ageing, heat treating, electronic-measurement of switch calibration accuracy. No other company can invest so much skill in **every** control.

Advanced engineering

Precision gave multiple lighting its "reliability breakthrough" five years ago and continues to lead the field with the only control designed, engineered and developed for one purpose — precise regulation of artificial lighting twice each day through rigid and unfailing response to natural light levels. Other controls are adaptations from obsolete tube-type controls containing up to 18 fragile components. Precision controls have only 2 components. Precision engineering eliminates all inherent fail-out hazards of capacitors, contact balances, magnetic relays, rectifiers, sensing flexible leads, tubes and printed circuits.

Laboratory production

Precision controls are built entirely by technicians, to insure the human-eye responsiveness with all-weather durability demanded in multiple lighting control. Major utilities in every geographical region of North America have contributed field-engineering recommendations during the past four years that have made these controls virtually fail-proof on 400,000 installations. They will utilize the expanded production facilities of Precision to put thousands more of these perfected controls on the line in 1961.

Field service engineers

Because Precision controls are used on more different installations than any other tubeless control, our field engineering representatives have unique experience in automatic control of multiple systems under all conditions. They are your ablest advisors in matching this perfected control to your most specific demands of weather, surge, lightning or light levels.

Write or wire today for data and quotations.

PRECISION MULTIPLE CONTROLS, INC. • Ridgewood, New Jersey

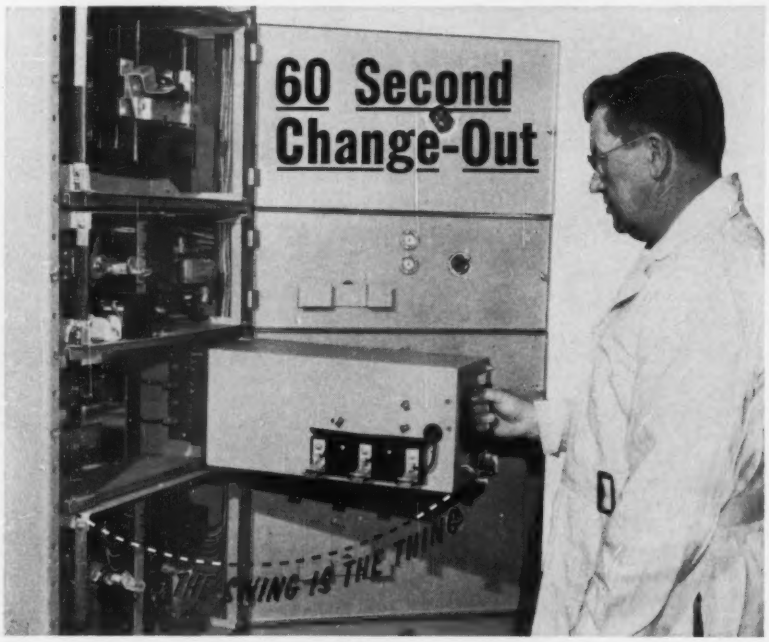
The difference between night and day

It's All NEW . . . In Concept In Application

Automatrol

► FROM NELSON

The First Motor Control Center Specifically Designed for use with Automated Systems



60-seconds or less is all the time required to change-out a starter or circuit breaker in the new Nelson AUTOMATROL motor control centers.

No tools, no specially trained personnel are required. You simply open the door, release the safety latch, swing the unit out and lift it off the pin hinges. You install the new unit just as easily. What could be more important when production is stopped?

This is only one of many new features found in Nelson AUTOMATROL motor control centers that are designed specifically for automation systems. For complete information write for Bulletin 2001 or call your local Nelson representative.

BIG ENOUGH TO PERFORM — SMALL ENOUGH TO CARE

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

P. O. BOX 5385 NATIONAL 7-5530

Modified Auto Jack Spreads Boiler Tubes

Repair and preventive maintenance of boiler and superheater tubes at Wisconsin Public Service Co's Pulliam Plant have been simplified by using an ordinary automobile bumper jack with homemade modifications. It is estimated that 300 manhours per year can be saved by using the bumper jack instead of chain hoists to spread the tubes.

With the old method of inspecting and welding boiler and superheater tubes, two chain hoists and four cable slings were used to spread the tubes. Hoists and cables had to be transported to the boiler area and a stable fastening point found. Rigging the chain hoists and cable before and removing them after the job required much time.

These operations also were a hazard to people involved in repair work. And in using the chain hoists, superheater tubes often were pulled at an angle, with the result that many tube hangers were cracked.

The new method spreads tubes straight out instead of at an angle, thus avoiding cracked hangers. And because only a small jack is required, less time is needed in setting up and removing of equipment for any given job. To modify the jack for the job, two steel horns were formed in the plant's own shop and fitted to the shape of the tubes. The horns were welded, one near the bottom of the jack shaft and one on the lifting pad.

(More Maintenance on page 105)

GET INTO ORBIT with...

SHAWMUT'S®

all new
silver plated

ONE-TIME FUSE

Les Maintenance says:
SHAWMUT'S® All New One-Time FUSES can't be beat because they...

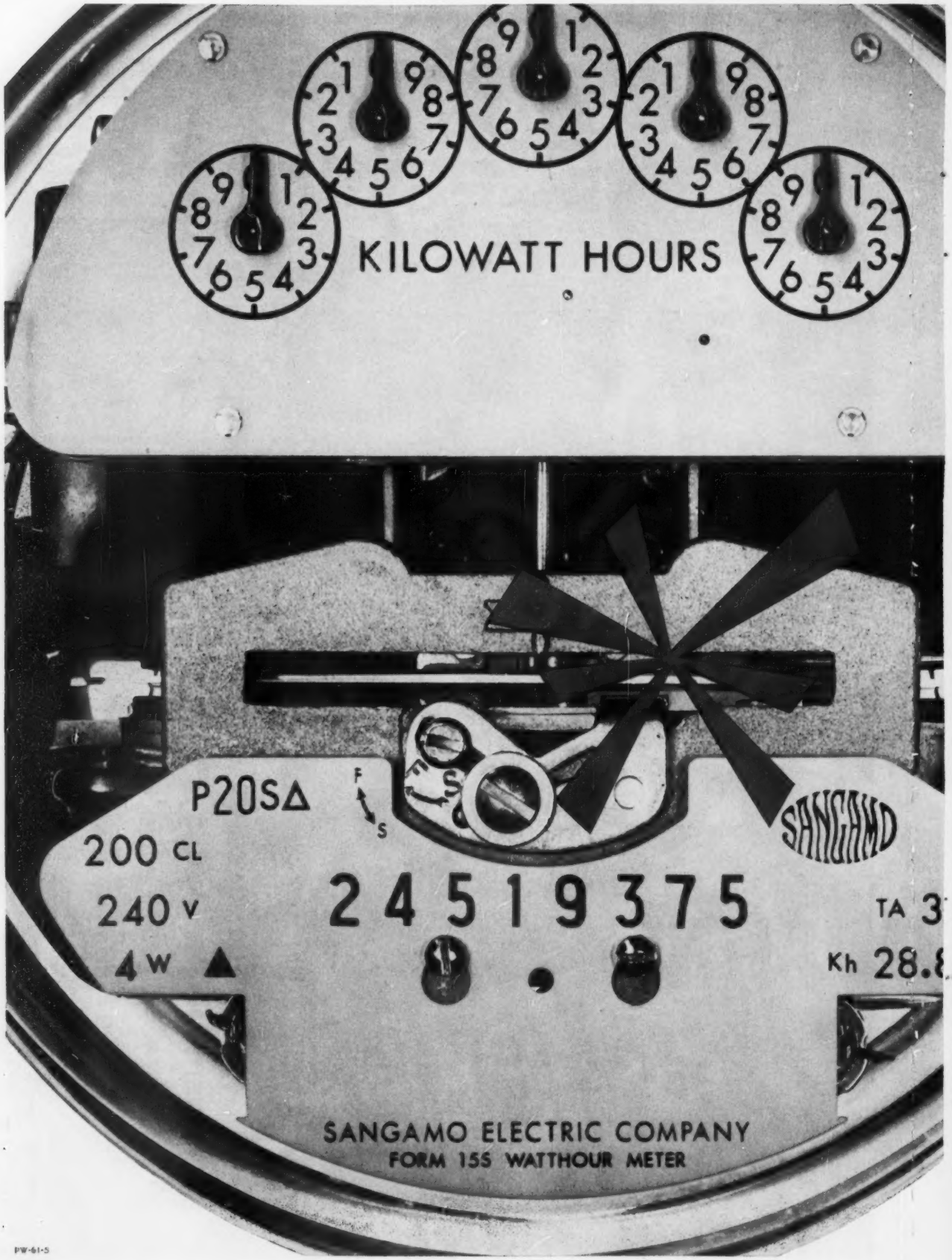
1. Give predictable performance.
2. Run 38% cooler in switches and enclosures.
3. Give up to 700% more Time Delay.
4. Meet all Federal specs. for One-Time and Time Delay fuses.
5. Exceed all industry standards for One-Times.
6. Are U. L. Approved.
7. Save power through low watt loss.
8. Are the only tested and proven AC-rated One-Times, Shawmut's New One-Times can pay for themselves through power savings alone.

Write for Bulletin O-T 601 today.

LOOK FOR **SHAWMUT'S *ALL NEW* ONE-TIME** — The fuse that makes all other One-Times obsolete. Provides *modern* protection for either old or new power circuits. Ask for Bulletin O-T 601.

THE CHASE-SHAWMUT CO.
374 MERRIMAC ST., NEWBURYPORT, MASS.
SUBSIDIARY OF I-T-E CIRCUIT BREAKER CO.

CIRCLE 101 ON READER SERVICE CARD 101


KILOWATT HOURS
P20SΔ
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240 V
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TA 3
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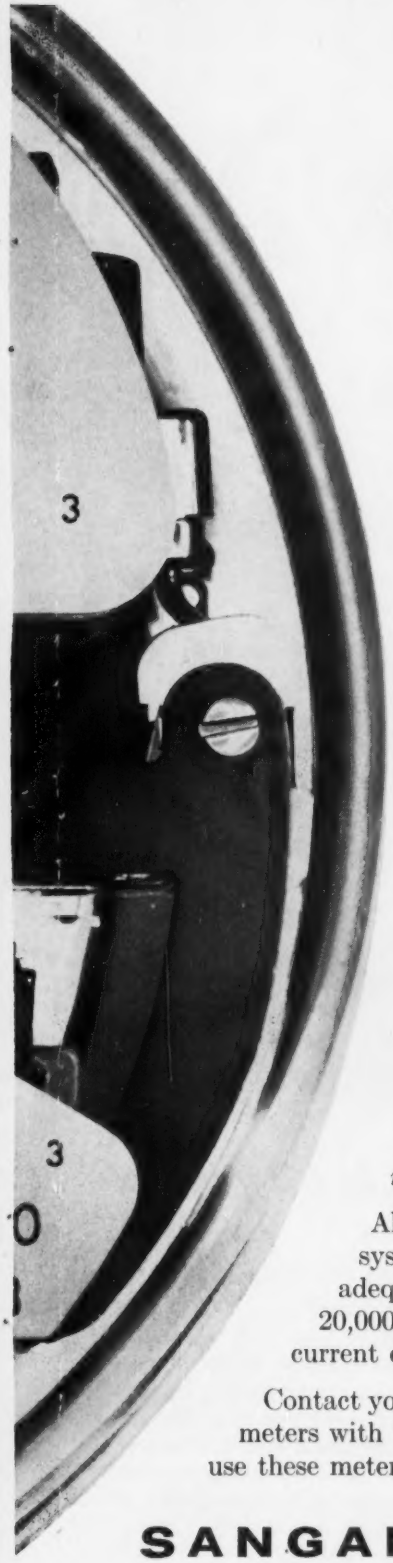
SANGAMO ELECTRIC COMPANY
FORM 15S WATTHOUR METER

PW-61-S



the maker's Sangamo...
the meter's polyphase...
and the disk floats...

to provide the highly sustained accuracy needed to better measure today's large loads. The moving system of these 2 and 3 stator polyphase meters floats freely and permanently on a magnetic field created by opposing magnets. It's not supported or suspended by friction-causing components. *This is true magnetic flotation,* made extremely stable by specially bonded Alnico magnets that are dimensionally and magnetically uniform. It's available now on the complete line of Sangamo P20 (two stator) and P30 (three stator) polyphase meters.

P20 and P30 meters, with true magnetic flotation, retain all the advantages traditionally associated with Sangamo polyphase meters such as slow speed, high torque, high insulation level, low losses, and low starting watts. Construction is still sectionalized and parts are interchangeable . . . only the frame has been changed to accommodate the floating system.

The compact outline of Sangamo polyphase meters hasn't been changed. The P30, for example, is the *lightest, smallest, three-stator meter made . . . the only one with single disk, round cover design.*

All components of the P20 and P30 meters, including Alnico floating system magnets, damping magnets and electromagnets, have more than adequate surge resistance. The meters easily pass high current tests of 20,000 amperes through the neutral wire and 2,000 amperes through the current coil.

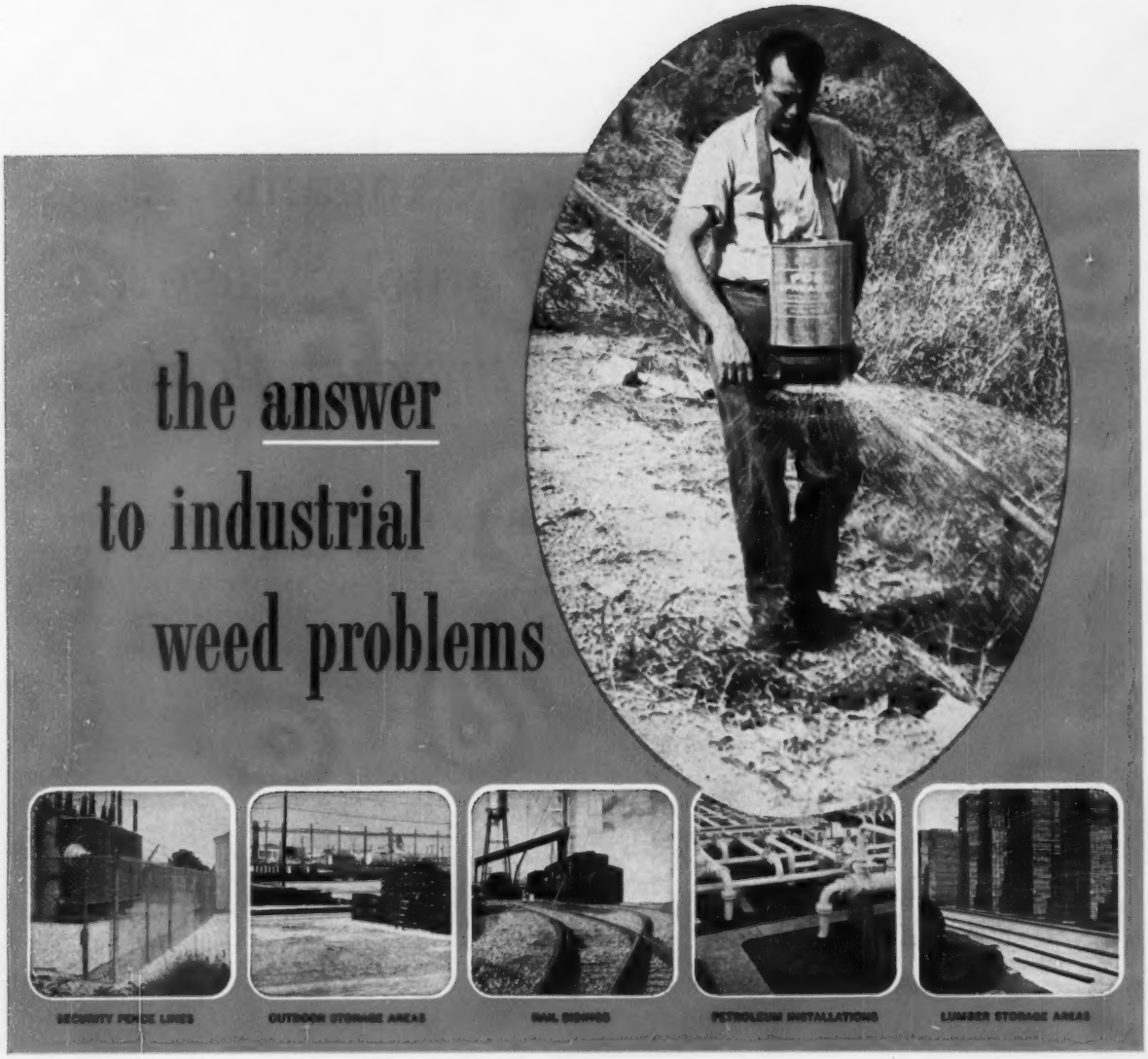
Contact your Sangamo Representative and get the full story on these exceptional meters with the moving system that is guaranteed for the life of the meter. Then use these meters to insure full revenue from large loads.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

SANGAMO

CIRCLE 103 ON READER SERVICE CARD



any man can weed-proof 10,000 sq. ft. in ten minutes

with **UREABOR®** This is the weed killer that's setting new standards for big economy with maintenance men from coast to coast. During the past six years, users have proved that, for low cost, safety, effectiveness . . . ease of application . . . UREABOR can't be beat!

Here is the dry granular weed-killing material that is always ready for you to use. There's nothing to mix — no water to haul. To destroy unsightly and hazardous weeds and grasses for a full season, you'll only use 1 to 2-lbs. per 100 sq. ft. That's because UREABOR combines the plant-destroying powers of *two* proven herbicides to give both a quick kill *and* a long-lasting control.

A special spreader is made to apply UREABOR uniformly and fast at low rates. Its low-cost does not reflect the tremendous value of this spreader to any user of UREABOR since it enables a man to weed-proof any area at the rate of a thousand feet per minute! If you have a weed problem, we want you to have the full story about UREABOR weed killer. Write today for details and name of a near-by distributor.

U.S. BORAX

UNITED STATES BORAX & CHEMICAL CORPORATION, Agricultural Sales Dept., 630 Shatto Place, Los Angeles, California

SMALL UNIT highly maneuverable

Power Sweepers Save Their Cost in Short Time

Large and small power sweepers have cut cleanup cost appreciably in Georgia Power Co's new service center. Not only do the sweepers speed up the job, but they also make it practical to keep the many acres of the center in top condition.

Initially a large model power sweeper was purchased. It was used very successfully in the warehouse areas, the open sheds, the garage and on the large paved areas outdoors. It quickly saved its cost in manhours.

However, experience soon showed that the large sweeper could not get around satisfactorily in the repair shop where there is much machinery and where clearances were not sufficient for handling the large sweeper. The large sweeper had been so successful in the other areas that a small model was purchased for sweeping the machine shop. It can get in and out of places and around the machinery satisfactorily and has saved the time of one man. The small sweeper also paid for itself in a few months.

Georgia Power's supervisors uttered one word of caution. Some men handle the sweepers well and have little or no mechanical trouble with them. Other men do not do so well and have frequent breakdowns. The only way they have been able to determine which men are good operators is by trial.

CIRCLE 29 ON READER SERVICE CARD

(More Maintenance on page 106)

Your biggest value in

DIGITAL DATA LOGGING

Data-Master® modular design makes data logging easy, economical, and outstandingly versatile

You select only the Data-Master modules you need. You never have to settle for less than you need, never have to buy more than you need.

Only Data-Master gives you this outstanding freedom of choice. For example, look at these standard optional features:

- *Digital clock, calendar*
- *Digital multiplier*
- *Alarm options*
  - *Common limit*
  - *Multiple limit systems*
  - *Scan for alarms between log cycles*
  - *Alarm scanning only*
- *Read-out options*
  - *Typewriter*
  - *Tape punch*
  - *Card punch provision*
  - *Printer*
  - *Strip chart record*
  - *Combinations of above*

. . . And many others

Logs practically any variable over any range, for example: temperature, pressure, flow, liquid level, pH, humidity, etc.

Automatically logs data from up to hundreds of points, hundreds of instrument readings.

Low maintenance—Maintenance is simple, can be done by your own man. No waiting for a "factory expert." Modular design allows easy checking.

For more complete information, write to: 0.45

THE BRISTOL COMPANY

Waterbury 20, Connecticut

Or nearest Bristol Branch Office

BRISTOL'S

THE DATA-MASTER CORPORATION

Subsidiary of The Bristol Company, Waterbury 20, Conn.

ACCO

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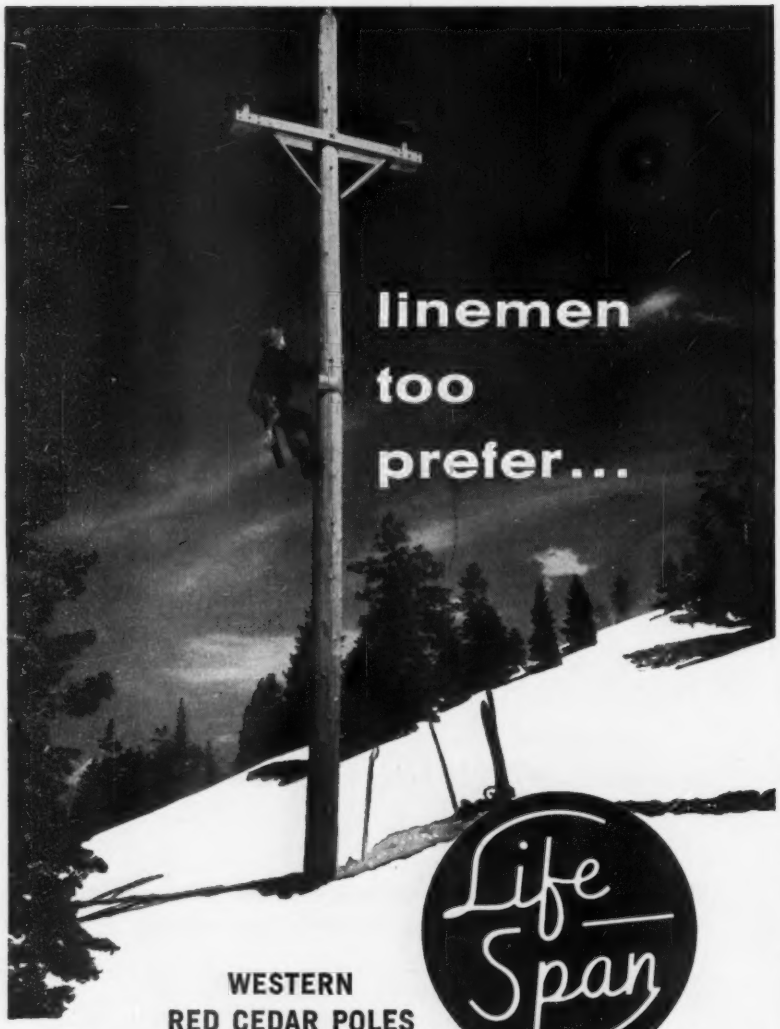


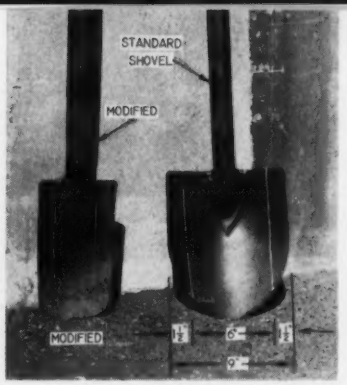
WESTERN RED CEDAR POLES

They're Safe, Clean to Climb and Deliver Many Added Years of Trouble-free Service

LIFE-SPAN Western Red Cedar Poles are clean and protected from top-to-butt. They are the result of years of continuous research and are **completely** immune to decay. To serve the utility industry better, Page & Hill maintains three mechanized yards with modern handling equipment. The LIFE-SPAN treatment applied to P&H poles complies with all approved E.E.I. or A.W.P.A. Thermal specifications.

When you buy — specify LIFE-SPAN Western Red Cedar Poles! They're your assurance of longer pole-line service at far less per annum cost.

PAGE & HILL, Inc.
MINNEAPOLIS 3, MINNESOTA



Modified Shovel Digs Pole Holes Faster

L. M. ABSHER and **J. C. SHELTON**, Line Foremen
L. S. CALDWELL, Lineman "A," Appalachian Power Co, Roanoke, Va. —AEP System

Cutting 1½ in. off the sides of a standard 9-in. shovel achieves a digging tool which does a better job in three-fourths the original time and which will dig without help from a digging bar or other tools—it can be used for digging anchor holes as well as pole holes.

In this day of mechanization, it may appear strange that there is still an interest in digging pole holes with shovels. The truth of the matter is that there are many places where digging equipment cannot be brought in or where it wouldn't pay to do so.

The standard digging shovel is about 9 in. wide and has a length, with handle, of 10 ft and requires considerable effort for deep digging. Frequently the shovel sticks in moist soil due to its curved shape. Use of a digging bar is often needed. Furthermore, the standard 9-in. shovel cannot be used for digging 8-in. anchor holes.

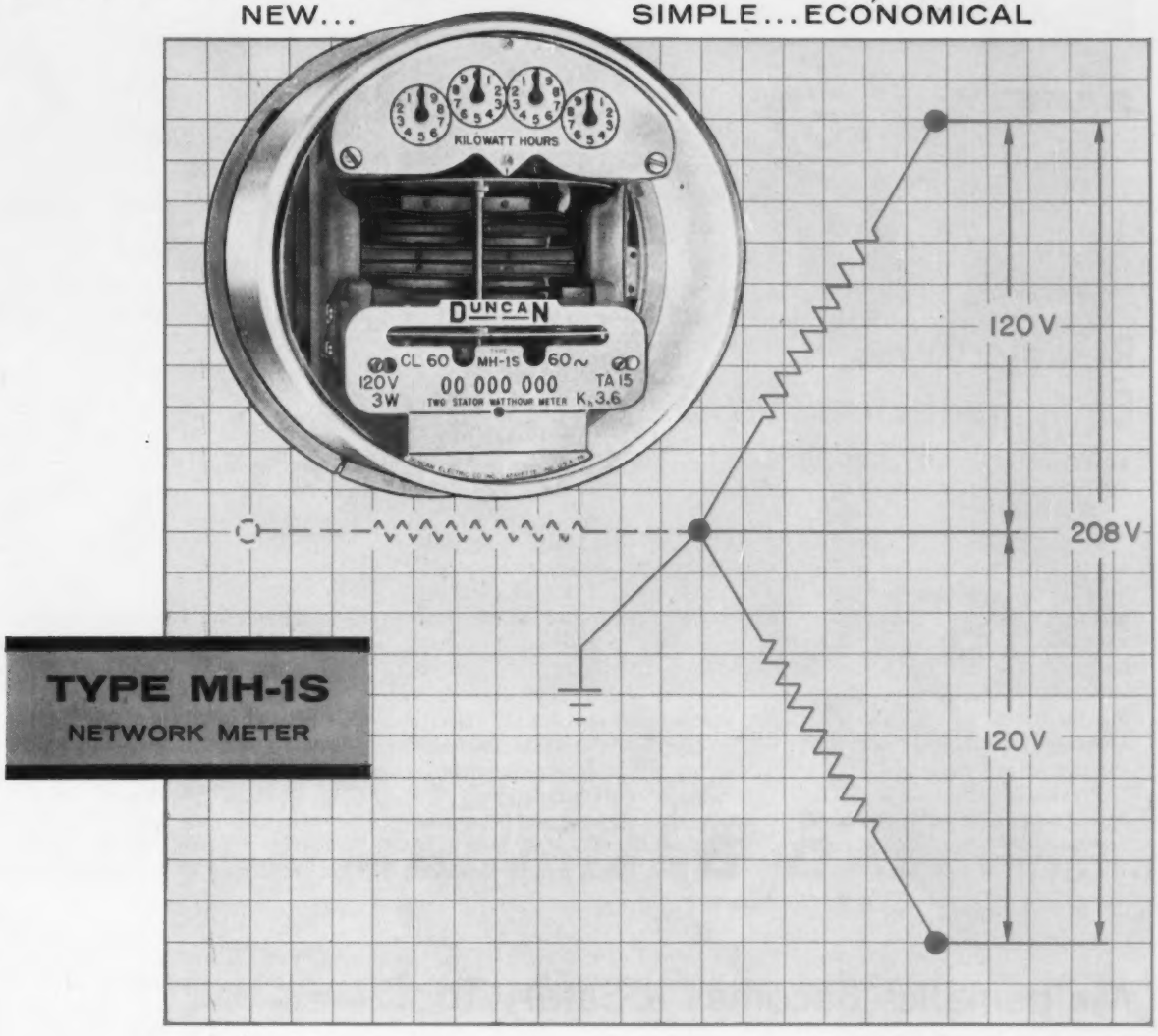
By cutting 1½ in. off each side, the standard shovel can readily be modified to a 6-in. shovel that solves these problems.

Since the narrow shovels originally were not commercially available, we first made our own by cutting down the standard-size shovel. The job takes about a half hour per shovel for small quantities.

The advantages of the modified shovel have recently prompted several manufacturers to add similar shovels to their standard line.

Another **DUNCAN** *Development*

NEW... SIMPLE...ECONOMICAL



TYPE MH-1S
NETWORK METER

The MH-1S—the newest network meter in the industry! Duncan's new meter is a simplified two stator watthour meter with customary adjustments eliminated, reduced weight, increased stability, lower price, and the same high quality performance.

The MH-1S is initially calibrated at the factory by adjusting the strength of the damping magnets. Fine adjustments, as required, are made with torque balance adjusting screws. Duncan has simplified construction and assembly of the electromagnets by keying the potential and current coils together in a die-casting operation and assembling them directly to the frame.

Use of Alnico high-energy surge-resistant damping magnets in the MH-1S assures calibration stability for the life of the meter. Alnico magnets were pioneered by Duncan over 25 years ago, and with simplified assembly and adjustments, make the MH-1S a "User Approved" meter.

DUNCAN
ELECTRIC CO., INC.
LAFAYETTE, INDIANA

"Thinking Ahead... Moving Ahead... to stay Ahead of Demand"

WATTHOUR METERS • MOUNTING DEVICES • DEMAND METERS

ELECTRIC UTILITY METHODS

EUM SAFETY

REMOTE CONTROL BUTTONS, operated by author, Robert Stillway, raise and extend derrick

Remote Control of Line Truck Power Equipment Eliminates Hazards

ROBERT STILLWAY, Shop Supt,
WAYNE SMITH, Distribution Eng'r,
Idaho Power Co, Boise, Idaho

Remote control of hydraulic equipment on Idaho Power Co's line trucks provides the safest and most efficient working environment by enabling a single operator to stand clear where his view is unobstructed when changing the truck speed, raising or lowering stabilizers, operating the derrick or the winch.

Previously, the controls for derricks were located at the back, on the curb side of the truck, which made it necessary for an operator to stand there to operate the derrick. At times, his vision was somewhat limited; other times he found himself between the truck and a swinging pole or transformer. The winch was controlled from the cab, so that two operators were sometimes needed.

The remote control system, worked out by the authors in company shops, uses electric solenoids to actuate hydraulic valves which, in turn, control the various work functions. The solenoids are actuated from pushbuttons on a control box easily held in one hand. Included among the 13 buttons is a "panic" button which stops all movement in a hurry.

If the electrical system should break down, the hydraulic valves automatically return to OFF position and can be manually operated as easily as the original system.

Idaho Power trucks have a 40-ft cable between the control panel and solenoids. This length allows the operator to control all hydraulic equipment on the truck from any position advantageous to him, whether it be in the cab or on the ground.

Mathematics Becomes a Safety Tool

Safety officials at Wisconsin Public Service Corp are using mathematics to dramatize the need for head protection on the job. Using typical lineman tools as examples, the electric utility's safety advisors in Green Bay, Wis., have shown, mathematically, that it is just about impossible to duck objects falling from heights at which linemen work.

To prove their point, they cite a hypothetical incident in which a lineman drops a 12-oz crescent wrench from a 65-ft pole:

If a lineman drops a wrench, it would take him ½ sec to realize he had dropped it and to yell "Headache." It would take a man on the ground another ¾ of a sec to hear the warning and react to it. Even then, he would not know which way to dodge until he had looked up. This might take another ½ sec. By the time he looked up, the wrench would be 4 ft from the groundman's head and would be traveling at about 40 miles per hr.

The safety mathematicians' case becomes even more convincing (see table) when they compute the striking force of tools and parts dropped from heights at which linemen work.

Item	Weight (Oz)	Striking Force (ft-lb) When Dropped From 32 ft	48 ft
Square washer	3½	7	11.7
13.5-kv insulator	41	88	132
Lag screw	3½	7	11.7
⅝x16 thru bolt	26	52	78
⅝x18 thru bolt	30	56	84
10-in. crescent wrench	12	24	36
12-in. crescent wrench	24	48	72
9-in. pliers	15	30	45

patent applied for

PROTECTION AGAINST MAIN LINE DAMAGE

Blackburn SC series clamps offer an effective way to protect main conductors against damage from hot line taps without the use of armor rod. Tap is made on extended bail . . . not on the main conductor.

High clamping force of massive clamp is maintained over large contact area, making a low resistance, cool operating main line connection. A low resistance, balanced current path is fed to the bail from both legs of the clamp. The bail is mechanically bonded to the clamp body with interlocked tubular compression sealed joints.

Castings are of high strength, non-copper bearing aluminum alloy. Clamps may be used on either aluminum or copper mains. When used on copper it is necessary to order prefilled with Contax, a highly efficient inhibiting paste. Bails are provided in bare copper, tin plated copper or aluminum. All bails are available straight or with a 45° offset.

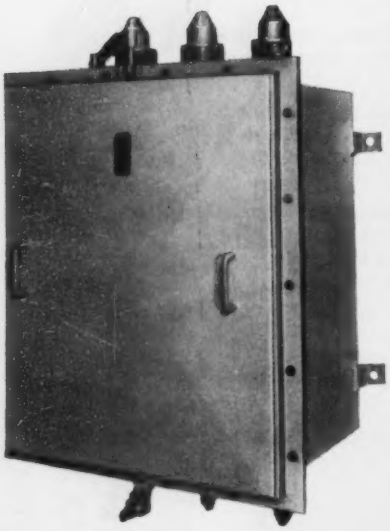
Blackburn stirrup clamps are easily installed hot or cold. Hex nuts or eye nuts (that fit all shotgun sticks) are available. A permanent steel spring secured to the body of the clamp imparts a strong snap grip on the interlocking jaws, supporting the clamp on the main while bolts are being tightened. Only two clamps cover a main wire range from No. 4 AWG through 397.5 ACSR.

For complete information, write for catalog data sheet and samples.

Jasper
BLACKBURN
Corporation

1525 Woodson Road • Saint Louis 14, Missouri

Who ever heard of hanging 500,000 kva on a wall?



▲
Submersible style for use in basements or vaults where flooding is a possibility.

▶
Indoor-outdoor style for general application where there is no possibility of flooding.

Do it with S&C's new line of high-voltage metalclad fuses for wall mounting

Here is a steel-enclosed fuse that gives you economical and fully adequate high-voltage fault protection for small loads:

1. *At service entrances;*
2. *On transformer primaries;*
3. *At underground sectionalizing points.*

S&C's new line of metalclad fuses combines economy with high fault interrupting capability. Their compactness permits wall mounting, eliminating the floor area requirements of conventional free standing metalclad switchgear. And much less room height is needed.

These fuses are especially suited to applications that justify fault protection *only*—applications where infrequent load switching (and isolation for rare fuse replacement) may be done elsewhere.

To permit you to tailor the new S&C Metalclad Fuse—Type SM to your particular requirements, a complete selection of features and ratings is available:

- Indoor Style, Indoor-Outdoor Style, or Submersible Style
- 4.8 kv or 14.4 kv
- 200E or 400E continuous amperes
- Cable entrance by knockout, flange-mounted pothead (1/C or 3/C), or integral pothead (1/C)
- 45,000 kva to 500,000 kva fault interrupting, in convenient steps

For further information, call your nearest S&C Sales Office. Consult the Yellow Pages under "Electrical Equipment" for the telephone number and address in all principal cities.

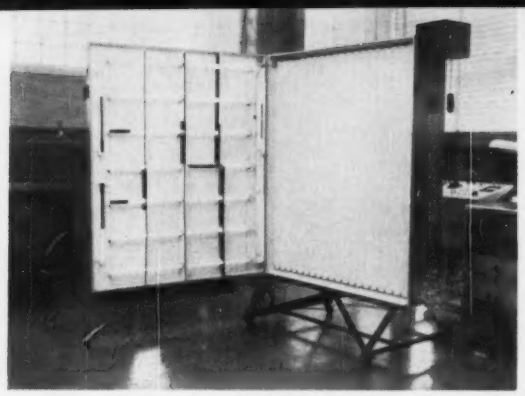
S&C ELECTRIC COMPANY

4421 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1911

CIRCLE 111 ON READER SERVICE CARD

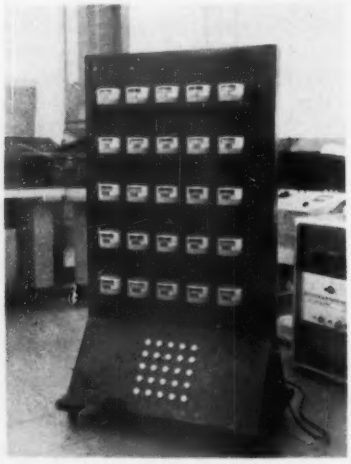
Check 25 Street Light Controls With Wide-Screen Light



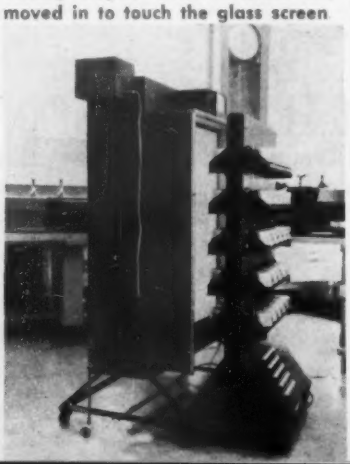
SOURCE OF LIGHT is 18 tubular filament lamps (on hinged door) which shine through motor-driven shutter

R. J. ROWSOME, Engineer, Standards Laboratory, Meter Dept, Detroit Edison Co, Detroit, Mich.

To maintain the calibration of an ever-growing number of photoelectric street light controls, Detroit Edison Co designed and built a wide-screen light source that checks 25 controls simultaneously. The light source provides a range of 0-10 ft-c and has a remote control for varying the light intensity on the screen.



PORTABLE TEST RACK holds 25 controls on each side. Pilot lights at bottom of rack indicate when controls on other side of rack turn on. Testing begins when controls are moved in to touch the glass screen



Need for this multiple-control checker arose with a swing to multiple street lighting circuits and individually-controlled luminaires. The larger number of controls in service placed a greater demand on the calibrating services of the laboratory and emphasized a desire to go beyond the conventional practice of using a device that tests one control at a time.

The wide-screen light source consists of 18 tubular filament lamps enclosed in the rear of a box measuring 44x54x12 in. and mounted on casters. A door at the back of the box provides access to the lamps.

Directly in front of the lamp bank is a shutter driven by a reversible motor. Between the shutter and the opal glass screen on the front of the box are two layers of opal glass for diffusion of the light. The glass screen is set in about 6 in. from the edges of the box to eliminate non-uniform light around the edges. In addition to the opal glass diffusers, it was necessary to use baffles and to darken certain areas of the lamps to achieve uniform illumination on the light screen. Finally, the light source has a light shield built around three sides of the screen.

A small box at the upper left hand corner of the box houses the motor and gearing to drive the shutter. A special cam in the drive causes the rate of variation of light on the screen to be uniform over the full adjustment of the shutter. A control switch on the box determines the direction of rotation of the motor. Also on the front of the box is a plug into which may be inserted a hand control switch for remote operation of the control motor.

A microammeter at the center top of the box indicates the output of four photovoltaic cells, one located at each corner of the inner surface of the front panel. The cells see the light variation as the shutter is operated. The microammeter is calibrated to correspond to the light level in ft-candles on the screen. A switch allows the output of the cells to be checked individually.

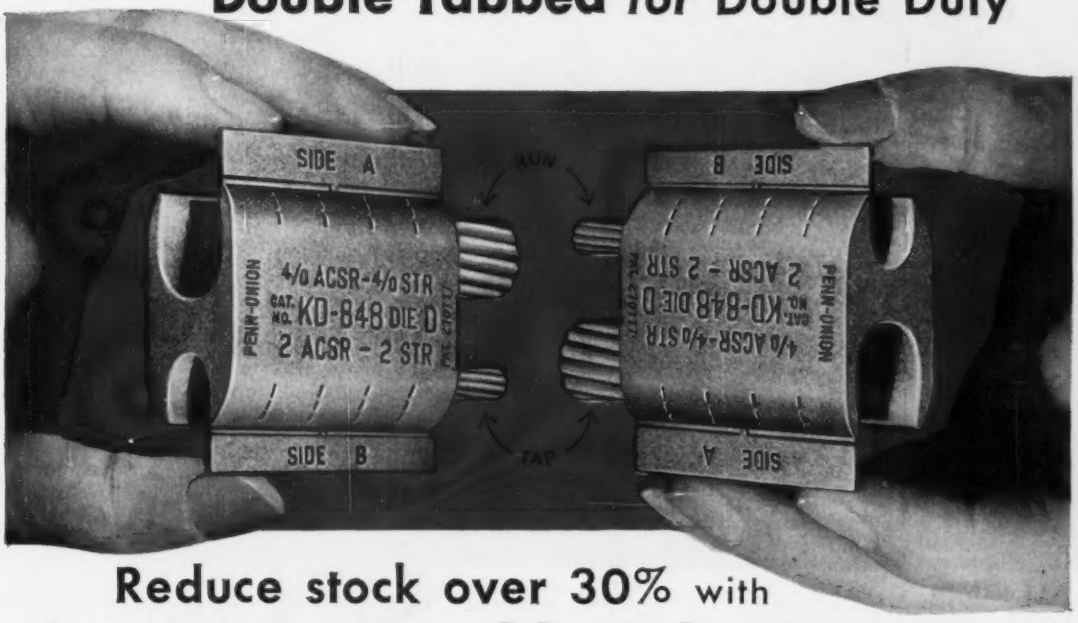
To check street light controls, the company mounted them on a special portable rack, each side of which is provided with five shelves fitted with five sockets. Also on each side of the rack is a set of pilot lights, each light corresponding to a socket position on the opposite side. The pilot lights turn on as the controls operate to the "on" position.

During a test the rack is pushed in until the fronts of the controls touch the light screen. In this position, the light shield and the test rack protect the controls from room light. With the rack in position the operator uses the remote control switch to open and close the shutter. As each control operates, the numbered pilot lights indicate the control that operated and the microammeter indicates the light level at which the operation took place. To extend the life of the lamps in the light source, Detroit Edison operates them at slightly below normal voltage.

(More Stores & Shops on p 116)

REVERSIBLE

Double Tabbed for Double Duty



Reduce stock over 30% with

Penn-Union *Double-Tab* "Press-On"

Less Stock— Reversible for dual application.

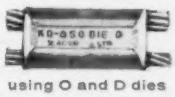
High Conductivity— E. C. Aluminum extrusions assure cool running high efficiency contacts.

Easy Crimping— Fully annealed for easy installation— deep indent crimp lines.

Pre-Loaded Inhibitor— Cleaned contact surfaces kept free of oxide re-formation by non-dripping Penn-Union "Cual-Aid." In colored polyethylene bag printed with complete information.

Crimp with tools you have

HAND or HYDRAULIC



using O and D dies

Cu to Al— Heavy spacer provides conductor separation and prevents strand cutting. Also minimizes galvanic corrosion.

Weather-Protected—Full-length tab provides complete enclosure for inhibitor.

Cable Protection— Heavy chamfering of cable openings protects main and run.

The Complete Line— Double Tab cable sizes #6 through 4/0. Single Tab cable sizes to 400 MCM.

PENN-UNION ELECTRIC CORP., Erie, Pa.

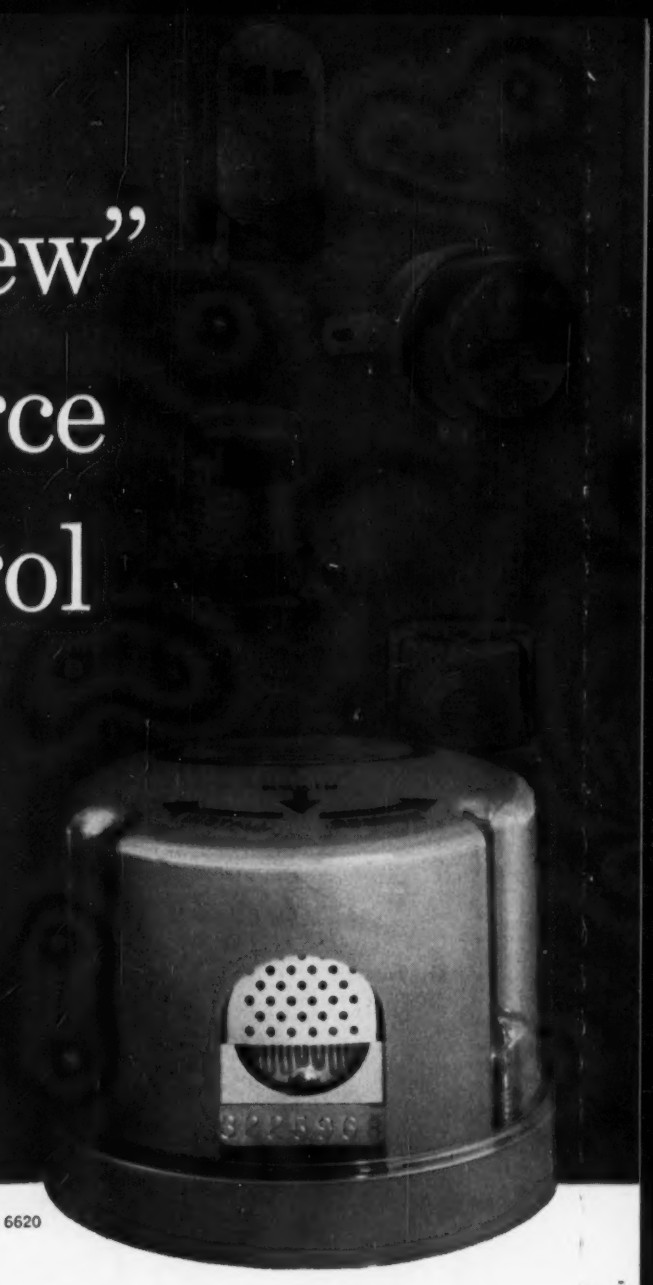
Export Sales—Philips Export Co., 100 East 42nd St. New York 17, N.Y.

Sold by Leading Electrical Distributors

PENN-UNION *a good connection*

Catalog Sheets or Samples on Request

Why a "New" Fisher-Pierce photocontrol like this isn't born every day...



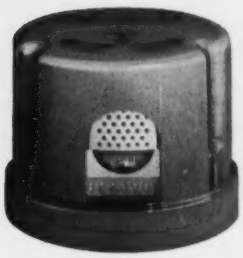
Model 6620

Call it "cautious New England conservatism" if you like, but offering a photoelectric street light control for widespread use by our utility customers throughout the country is something we do only when we're more than just "hopeful" that it will operate in the field the way the designer intended it to. Automatically, this means many hours of realistic testing under the conditions of actual use.

Fisher-Pierce now has an improved photocontrol to offer you and it's shown there in the photo captioned "Model 6620." It was developed for the same reason almost all new things are developed: to improve on what is presently available. From a sales standpoint it *is* new, but about five years of circuit design and component refinement lie behind it. We say it's an improved control because the circuit has fewer components *and dependably gives the same performance* as previous controls. (Cutting down the number of components *by itself* doesn't necessarily make anything "better" — only when it yields operation as reliable as you had in the first place.)

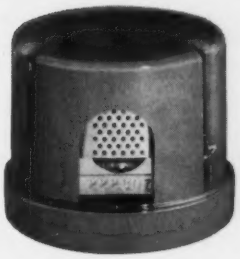
We think this new control is well worth trying.

NEW & SIMPLIFIED MODEL 6620



Design approach: simplify the 6600A circuit without sacrificing performance or long life; use of new, fully tested Sigma AC relay permits elimination of certain components; 1000-watt capacity; guaranteed for two years.

THOROUGHLY FIELD TESTED MODEL 6600A



Fully proven with billions of service hours in field installations of all types; 1000-watt capacity; Model 6607 available for mounting bases 3⅜" in diameter; Model 6700 available for use on 240-volt lines, fits 3⅜" mounting bases; guaranteed for two years.

NEW, 500-WATT CAPACITY MODEL 6650

Designed for farm lighting, other lower-wattage installations; similar to Model 6620 controls except for reduction of contact rating; ideal for use by utilities, REA's and cooperatives in promotion of farm and suburban lighting; guaranteed for two years.

other Fisher-Pierce controls and related equipment

TYPE 250A MULTIPLE RELAY for increasing by 3000 watts the load capacity of a single photoelectric control; compact, weatherproof, low cost.

SERIES 63300C CONTROL with 3000 or 6000 watts capacity; turn-on 0.5 to 500 foot-candles; weatherproof head enclosure fits meter socket.

SERIES 6100 CALIBRATOR for simple, rapid checking and adjustment of operating points of all F-P and nearly all other types of photoelectric controls.

For complete design information and operating specifications on all Fisher-Pierce equipment, write Fisher-Pierce Division, Sigma Instruments, Inc., 82 Pearl Street, So. Braintree 85, Mass.

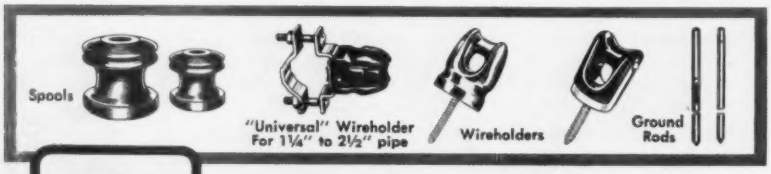
FP
FISHER PIERCE

CIRCLE 115 ON READER SERVICE CARD

NEW OVERSIZE WIREHOLDER for large pipes

Utilities, industrial maintenance departments and electrical contractors will find many uses for this new oversize pipe mounting wireholder. It is quickly and easily installed on either 3" or 4" pipe. Massive insulator is copper bail reinforced for superior strength and corrosion resistance.

Porcelain Products Co. of Carey, Ohio, also makes other items ideal for utility use including a full range of wireholders, spools, ground rods, and some 120 other products. Write today for complete catalog.



PP **PORCELAIN PRODUCTS CO.**
225 N. Patterson St. • Carey, Ohio

CIRCLE 40 ON READER SERVICE CARD

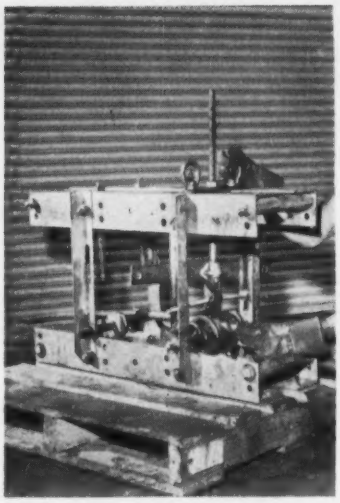
KEES SOCKET METER COVER

Fits All Standard "S" Type Meters

Made from 16 gauge zinc-coated, rust resistant steel and finished in gray baked-on enamel, the KEES Socket Meter Cover is designed to prevent breakage of glass on socket meters to insure long service in any climate. Outside diam.—8" and depth—5⅝" and over. Metal cover is also reported to minimize damage from excessive current surge due to electrical storms.

Write P. O. Box 844 for Free Electrical Catalogue.

F. D. KEES MFG. CO.
BEATRICE NEBRASKA
Since 1874



'SURVEYED' UNDERGROUND CABLE is fitted into 'stripper.' Cable is pulled through the machine, blade cuts insulation—metal is salvaged

Salvage Weather-Proof Copper Cable With Stripper

Kansas Gas & Electric Co is saving up to 20¢ per lb on the cost of copper ground wire, thanks to a machine built by nine of its storeroom employees. The device cuts insulation away from scrapped weather-proof cable to provide bare copper for use as ground wire. The saving is the difference between the old wire's salvage value and the cost of new ground wire.

Originally built to strip lead from underground cable, KG&E's machine is basically a frame which supports a cutting blade mounted above a set of rollers. Employees use a knife to make a guide slit in the insulation and the wire or cable is fitted under the cutting blade. A fork-lift truck pulls the wire through, slicing away the insulation.

Besides saving on the cost of ground wire, the device adds to the value of conductor for scrap. Underground cable, for example, is sold for 12¢ per lb if copper and lead are not separated. Once separated, copper is sold for 25¢ per lb and lead for 10¢.

No more stopping to clear chips

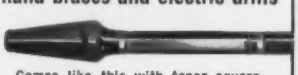
New Irwin Pole-Bor Bits save time . . . money

Now get easier, faster, non-stop boring action in telephone and power poles. Irwin Pole-Bor bits give continuous chip flow—even in creosoted wood. Special Irwin cutting head, twist angle, and smooth-polished hollows eliminate clogging and binding. Side lip smooths hole for easier insertion of bolts and pins. Heat tempering full length gives extra strength, more safety for the man on the pole.

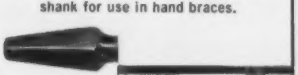
3 Lengths — 12 Sizes

New Irwin Pole-Bor bits come in 12″, 18″ and 24″ lengths, with 8″, 12″ and 18″ twists. Sizes range from $\frac{6}{16}$″ to $\frac{17}{16}$″. Use these new Irwin bits for just about any job — whether boring crossarms, small, medium or extra large poles, heavy timbers. And remember: Irwin's patented Adapter Shank fits both hand braces and electric drills. Save time and money. Use fewer bits on the job. Get Irwin Pole-Bor non-stop boring action and extra safety, too. Order from your Irwin distributor today. The Irwin Auger Bit Company, Wilmington, Ohio.

Irwin Adapter Shank fits both hand braces and electric drills



Comes like this with taper square shank for use in hand braces.



Cut off taper square shank. Use in both hand braces and electric drills. No wobble, no run-out.

IRWIN Pole-Bor Bits

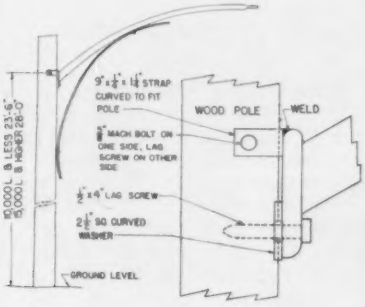
Obsolete Brackets Converted to New

FRED C. HESS, Mat'l Retirement Supr.
WILLIAM BLANKENSHIP, Groundman
Indiana & Michigan Electric Co,
South Bend, Ind.—AEP System

Modifying obsolete 6-ft street lighting brackets, salvaged from old ornamental metal-pole installations, provides a sturdy arrangement for mounting street lights on wood poles or in alleys and narrow streets, where such a bracket otherwise could not be used.

The 9-in. steel mounting strap is one third of a 28-in. crossarm brace. An $\frac{11}{16}$-in. hole is drilled ½ in. from each end; then the strap is curved to an arc and welded to bracket as shown. It should be bent to fit the pole before attaching with $\frac{5}{8}$-in. bolt and two ½x4-in. lag screws specified.

Cost for each adaptation is about $3, including $1.75 for galvanizing. Since brackets for wood-pole mounting can be purchased for just slightly above this, the main benefit is toward our continuing efforts to save storage space and reduce inventories of surplus items.


9"x½"x1¼" STRAP CURVED TO FIT POLE
WOOD POLE
WELD
⅝" MACH BOLT ON ONE SIDE, LAG SCREW ON OTHER SIDE
½"x4" LAG SCREW
2½" SQ CURVED WASHER
10,000 LBS LESS 23'-6"
15,000 LBS HIGHER 28'-0"
GROUND LEVEL

LABORATORY CONTROLLED... Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

ELECTRIC UTILITY METHODS

MANUFACTURERS LITERATURE

To request literature, use code numbers indicated for each item when filling in Reader Service Card

CONNECTORS

CABLE FITTINGS . . . Series 800, interlocked armor cable fittings, copper and aluminum, from 600 to 15,000 v. Dimensional data and ordering instructions. Catalog H, 12 pages. Also separate price list. G&W Electric Specialty Co, 3500 W 127 St, Blue Island, Ill. **(140)**

CONDUCTOR CLAMPS . . . for heavy-duty connection service under widely fluctuating loads and temperatures. Detail on three types of U-bolt clamps: two, aluminum with copper lining in one groove for aluminum-to-copper connections; two, aluminum without copper lining for all-aluminum or bimetallic connections; and one clamp for all-aluminum or bimetallic connections. Bulletin No. 6101, four pages. Jasper Blackburn Corp, 1525 Woodson Rd, St. Louis 14, Mo. **(141)**

DISTRIBUTION

POLE TREATING . . . describes groundline treatment, flow-on treatment, maintenance and inspection of wooden poles for overhead lines. Covers internal treatment and pole spraying, digging inspection. Brochure, eight pages. Pole Treating Co, 505 York Rd, Jenkintown, Pa. **(142)**

REGULATORS . . . single-phase, 32-step, distribution. Elementaries on main components and their relating functions, line drop compensator settings and their adaptability are covered in question and answer form. Includes basic diagrams, rating tables and calculation examples. Bulletin No. 61052, 12 pages. Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis. **(143)**

CUTOUTS . . . Positect-type enclosed distribution cutouts, most often applied as switching and protective devices for transformers, capacitor banks, and sectionalizing points on 4,160 and 4,800-v distribution systems. Switching data (with and without load interrupter attachment), cutaway working diagrams and complete re-fusing instructions. Illustrations of typical installations, including pad-mounted, pole-top and semi-buried applications. Bulletin 541, 12 pages. S & C Electric Co 4435 N Ravenswood, Chicago 40, Ill. **(144)**

FAULT INDICATORS . . . have a minimum trip range between 300 and 450 amp and will accommodate cable sizes from 5/16 through 1 13/16-in. over-all dia. Applications described, ordering and dimensional information given. Bulletin, SP3, four pages. Line Material Industries, McGraw- Edison Co, Milwaukee 1, Wis. **(145)**

LOW-VOLTAGE DISTRIBUTION EQUIPMENT . . . product selector charts, catalog index and complete descriptions. Buying data and general application information on heavy-duty safety switches, CLF current-limiting fuses, hinged wireway, circuit breakers, switchboards, motor control centers, power distribution centers. Catalog, GEC-1100C, 92 pages. General Electric Co, Distribution Unit, Plainville, Conn. **(146)**

INSULATION TESTING

DIELECTRIC TESTING . . . of an aerial device, the Asplundh Line Lift. Includes descriptions of materials utilized in construction, instruments used in conducting tests, the tests to which materials have been subjected, and results. Booklet, 12 pages. Asplundh Chipper Co, Hamilton St, Chalfont, Pa. **(147)**

INSULATION TESTERS . . . in the 500 and 1,000-v class with new extended sensitivities up to 10,000 megohms in 1,000-v instruments. The Meg type is newest of Megger insulation testers. Hand-operated, rectifier-operated, dual-operated, and two-voltage instruments offered. Most models may include the new four-position switch with megohm scale, divide by one and divide by ten; ohm scale; and capacitance discharge. Carry five-year warranty. Bulletin 21-45-9, 12 pages. James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa. **(148)**

TEST SETS . . . for maintenance, installation and proof-testing motors, generators, cables, bushings, transformers and switchgear of every size and description. Dielectric breakdown test sets range from heavy-duty types with ac or dc potentials to 150 kv, through mobile, bench and hand-carried portable models. Included are megohmmeters with ranges to 5 million megohms. Catalog 10-1.3. Associated Research Inc, 3777 W Belmont Ave, Chicago, Ill. **(149)**

METERS & RELAY

WATTHOUR METERS . . . standards for both detachable and bottom-connected watthour meters. Class designations, voltage and frequency ratings, test current values, internal wiring arrangements, performance requirements, pertinent dimensions, rotor markings, register requirements, and other general specifications. Prepared by the Assn of Edison Illuminating Cos, Edison Electric Institute, and National Electrical Mfrs Assn. EEI Pub No. MSJ-10; NEMA Pub No. EI 20-1960, 40 pages, $1.35. Assn of Edison Illuminating Cos, 51 E 42 St, NYC 17. **(150)**

(More Literature on page 120)

ANOTHER FIRST FROM HOLAN...

So New We Haven't Dressed it Yet

It's ready now — the first center-mounted derrick for the utility field that can be operated from a rotating crow's-nest. All that's left to be done is to sheathe in a famous Holan-built body.

But it has already been subjected to hour after hour of torturous digging and lifting in every position. And it can take it . . . take even the punishment of harnessing the 8,400 pounds of torque of the Holan 5400 Earth Borer.

The center-mounted 7700 erases the blind spots, permits the operator to dig and "live boom" 9,000 pounds . . . rotate 360° in either direction . . . extend and retract the 7-foot boom . . . set 80-foot poles. And he does it all with foot and hand controls . . . and with a safe, unobstructed view of his work area.

The derrick — including the base, superstructure and hydraulic outriggers — is built as an integral unit and can be easily mounted on the chassis at any point behind the cab.

Make it a promise to see this powerful and remarkably versatile derrick with its full range of optional equipment before you buy any center-mounted derrick. Call your Holan Field Representative . . . or write us today . . . for complete information.

HOLAN CORPORATION, 4100 W. 150th St., Cleveland 35, Ohio

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

Koenig ALL-STEEL UTILITY BODIES

LINE-CONSTRUCTION BODY

. . . available in 9' to 14'6" lengths with mechanical or hydraulic winch and derrick, or any other special or custom equipment desired. Compartments can be arranged to your specifications.

SERVICE BODIES

. . . for ½-, ¾-, and 1-ton chassis. Electrically welded into one unit with six waterproof compartments, recessed paddle handles keyed alike and fender skirt protected with die-formed rolled edges. Built for safe, dependable service . . . will outlast several chassis.

SIDE BOXES

For all pick-up trucks, including the new compacts. Watertight compartments . . . double panel doors . . . recessed paddle handles with cylinder locks keyed alike. Eleven types, seven lengths available.

YOU CAN BE SURE OF QUALITY MATERIALS AND WORKMANSHIP WHEN YOU SPECIFY KOENIG PRODUCTS

Write for literature and specific information today.

Koenig IRON WORKS, Inc.

P O. Box 7726, Dept. C
Houston 7, Texas

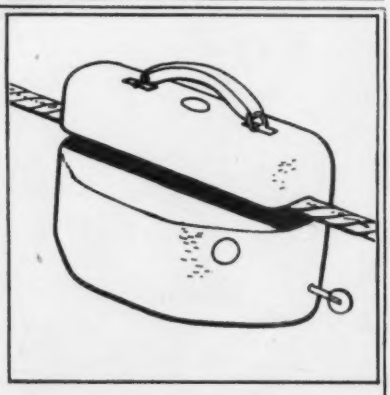
CIRCLE 42 ON READER SERVICE CARD

For emergency repairs or re-conductoring I can SHOW you how

TOW·A·LINE

will SAVE you

MONEY!



I am not selling a product, but a service which uses a compact, fully insulated, power-driven unit, TOW·A·LINE (patent applied for), for reconductoring or repairs in difficult areas such as through trees, across rivers, over heavy-traffic intersections, etc. On one recent job delayed by obstacles, TOW·A·LINE and the utility's own crew got a line in in 7 hours that a contractor had bid to complete in 6 days using 6 men. This is typical of man-hour savings with TOW·A·LINE. You can't tell much from what it looks like, but it's the results that count and TOW·A·LINE can produce them. You don't buy the unit, but simply rent the service. If you (contractor or utility) have a problem job, phone me and we'll talk it over. I can advise you of savings to expect, and if you can do it more cheaply another way, I'll tell you.

TOW·A·LINE CO. 5635 E. DRIVE, LOVES PARK, ILL.
PHONE 7-6719

More Literature

(Continued from page 118)

CONTACT DEVICES . . . for demand applications: the accurate selection of contact devices and effective use of impulse generators. Section covers methods of determining the proper contact device to transmit electrical impulses from a watthour meter to a demand meter, with extensive mathematical aids. Also formulas to convert from contact devices on meters having ball or pivot-type bearings to equivalent contact devices on meters having magnetic-suspension. "How to Select Contact Devices and Impulse Generators," Bulletin GET-3048, 12 pages. General Electric Co, Schenectady 5, N.Y. **(151)**

STANDARDS . . . on detachable and bottom-connected watthour meters, NEMA Standards Publication El 20-1960 Watthour Meters, $1.35. Also, cable terminating boxes for power transformers: air-filled boxes suitable for mounting on the side wall of a transformer rated 501 kva and above and with suitable provision for terminating cable. NEMA Standards Publications: TR 71-1960 Removable Cable Terminating Boxes for Power Transformers; TR 72-1960 Integral Cable Terminating Boxes for Power Transformers, each publication 35¢. National Electrical Manufacturers Assn, 155 E 44 St, NYC 17. **(152)**

ELECTROMAGNETIC RELAYS . . . engineering data on 42 different series. Mounting data and descriptions of wide variety of enclosures, information on various terminals. Industrial Catalog 60, 16 pages. Potter & Brumfield, Div of American Machine & Foundry Co. Technical Information Section, Princeton, Ind. **(153)**

MOTORS & CONTROLLERS

MOTORS . . . 23 types, with application uses and available ratings, enclosures and modifications illustrated and fully described. Ac and dc motors, special motors and gearmotors: line includes standard squirrel-cage motors from ¼ to 2,500 hp in open, enclosed, explosion and weather-protected enclosures. They have many modi-

fications, such as C or D flanges, P base, and vertical mounting. Also gearmotors to 150 hp, dc motors to 400 hp, wound-rotor motors to 800 hp, synchronous induction motors to 150 hp, plus alternators, generators and associated control. Bulletin 2651, eight pages. Louis Allis Co, Milwaukee 1, Wis. **(154)**

MOTOR CONTROLLER . . . the SpaceMaker, described as the first starter in the 2,000 to 5,000-v range with two-high motor control center. Also said to be about one-half the weight of conventional design. Employs new Type 456 5-kv air-break contactor. Available for squirrel-cage, wound-rotor and synchronous motors up to 2,500 hp at 4 to 5 kv and 1,500 hp at 2.3 kv in reversing or non-reversing, full-voltage or reduced-voltage starting. Multi-speed, plugging and breaking features also available. Unit carries 60-kv impulse rating, tests at 15-kv dielectric for 1 min. Bulletin 14B9739, eight pages. Allis-Chalmers Mfg Co, Milwaukee 1, Wis. **(155)**

(More Literature on page 122)

Specify
SHAW-PERKINS
COOLING
RADIATORS

Engineered and built by specialists. Full range of sizes and models, properly designed to give any make or capacity of transformer all the economies of thermo-siphon self cooling.

Valves, flanges, elbows, accessories, for any mounting condition.

Transformer tanks built to customer specification.

Write today for full information.

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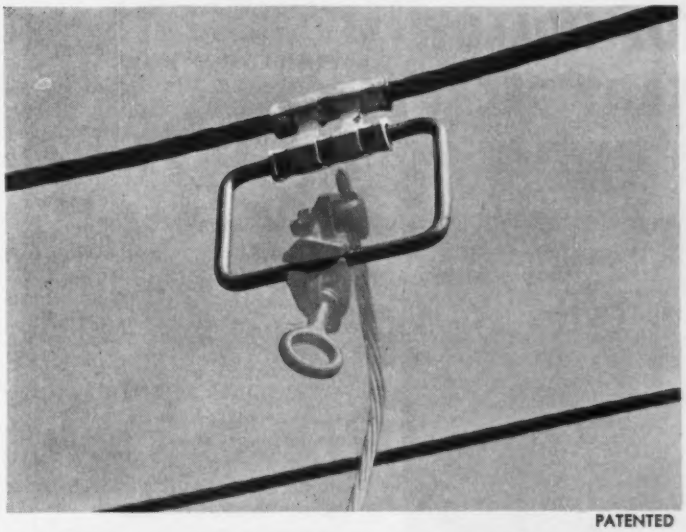
MANUFACTURING COMPANY
201 East Carson St. · Pittsburgh 19, Pa.

CIRCLE 43 ON READER SERVICE CARD

SAFELY INSTALLED BY ONE MAN
...IN LESS THAN 15 SECONDS
...ON A 46,000 VOLT LINE



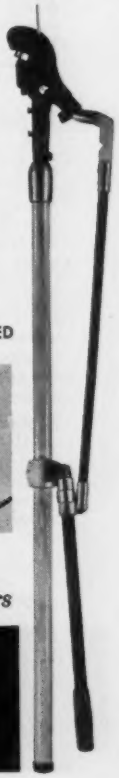
PATENTED

T&B-METHOD STIRRUP CONNECTORS and HOT LINE TOOL . . .

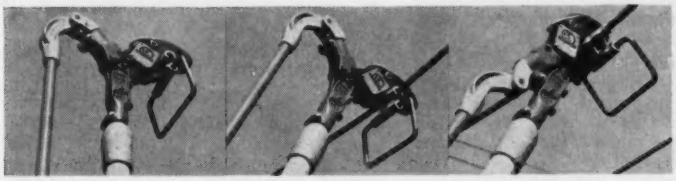
T&B-Method compression eliminates bulky bolts and screws . . . speeds and simplifies installation while giving you a more dependable, low-resistance joint. The T&B Stirrup Connector has a wide copper bail with enough clearance for two standard size hot-line clamps. Available plain or tin plated for #6-4/0 ACSR or stranded AL.

UT5E HOT LINE TOOL . . .

Interchangeable dies with built-in compression accuracy install the entire stirrup line, as well as splices, joints and compression tap connections. Tool is so well-balanced, it can be suspended from the cable when not in use. Just one squeeze of the handles for each compression. See your T&B Distributor, or write for Bulletin U1-27 to: The Thomas & Betts Co., Incorporated, Elizabeth 1, N. J. In Canada: Thomas & Betts Ltd., Montreal.



EASY AS 1 . . . 2 . . . 3 . . . PATENTED



LOAD IT! **HOOK IT!** **SQUEEZE IT!**

Sold Coast-to-Coast Exclusively by Authorized T&B Distributors

T&B ENGINEERED
THOMAS & BETTS

CIRCLE 121 ON READER SERVICE CARD

NOW - IT IS POSSIBLE TO STOP HOLLOW HEART DECAY

THE OSMOSE METHOD IS SURE, LONG-LASTING

Just a few years ago, decay in the interior of a pole at the ground-line area was considered a pretty hopeless case. Today, Osmose is saving many thousands of these afflicted poles with its exclusive Hollow Heart Treatment.

After boring, a specially designed Shell Thickness Indicator is used to evaluate the remaining wood strength in relation to the load. If the pole can be saved, the OSMOSE Hollow Heart treatment is applied. This consists of literally flooding cavities with a highly concentrated solution of toxic OSMOSALTS suspended in water. Decay is stopped in its tracks. Your poles remain sound for years and years more of safe, money-saving service.

Discover the full story of the OSMOSE program for ground-line inspection and treatment. Write Osmose Wood Preserving Co. of America, Inc., 991 Ellicott Street, Buffalo 9, N. Y.

OSMOSE

SERVING UTILITIES SINCE 1935

More Literature

(Continued from page 121)

POWER PLANTS

COMBUSTION INDICATOR . . . is a continuous reading instrument which accurately indicates changes in flame characteristics caused by variations in air/gas mixture. Qual-O-Rimeter combustion indicator's specifications and operation are completely detailed. Performance curves, schematic diagram, and labelled block drawing. Bulletin Q-2, eight pages. Selas Corp of America, Dresher, Pa. **(156)**

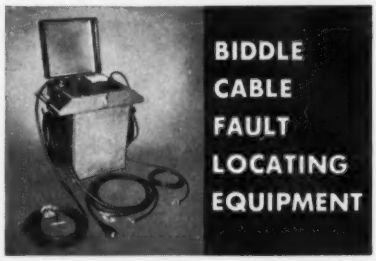
CARRIER-CURRENT . . . equipment, power-line. Product and application photos to illustrate communications role played by carrier systems in utilities' installations. Product categories include transmitter-receivers for general purpose and supervisory control, relaying, telemetering communications, coupling capacitors and potential devices, and aluminum traps. Bulletin GEA 7204, eight pages. General Electric Communication Products Dept, Box 4197, Lynchburg, Va. **(157)**

WATER TREATMENT . . . for high makeup boilers operating in the range of 600—1,250 lb. Selection of equipment at different boiler pressures and with different types of water: examination of four basic types of treatment, evaluation of use in typical plants with low, medium and higher solids water. Case histories of two plants, review of new treatment and testing methods—including condensate scavenging. Tables, flow diagrams and photos. Technical reprint T-183, eight pages. Graver Water Conditioning Co, 216 W 14 St, NYC 11. **(158)**

CONTROL LINKAGE SYSTEMS . . . typical linkage arrangements for fan-damper control, stoker-speed control, coal-feeder gate control and feed-pump fluid coupling control. Two general types of drives: those which include a positioning relay and those which include a self-contained diaphragm controller. Control drive torque ratings given are maximum valued determined at a 50-psig air supply. Drive levers and driven levers are

(More Literature on page 124)

. . . For Locating Faults in Lead-Covered Cable . . . For D-C Proof Testing



Has applications on aerial, or buried cable, as well as on lead-covered cable installed in ducts. Equipment combines a high-voltage capacitor discharge transmitter with a detector to form a complete Tracer Current Set. Provides high current and voltage output with small energy input. Equipment is moderate in size, weight and cost. Use is not restricted by networks or branches, and under certain conditions will even operate successfully without disconnecting transformers. Method of detection indicates whether fault has been reached or passed when an exploring pick-up coil is applied at various points along the cable.

Biddle Models	Output Voltage	Discharge Capacitance
Catalog 651125	Up to 25 KV	1.65 muf
Catalog 651015	Up to 15 KV	2 muf
Catalog 651005	Up to 5 KV	16 muf

B-1005 **Write for Bulletin 65-W**

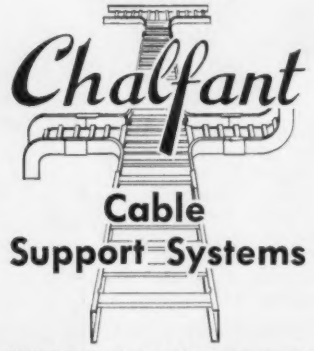
JAMES G. BIDDLE CO.
Electrical and Speed Measuring Equipment
1316 Arch Street, Philadelphia 7, Pa.

CIRCLE 44 ON READER SERVICE CARD

You DON'T Need

BOLTS WASHERS NUTS PINS

or Special Tools to install



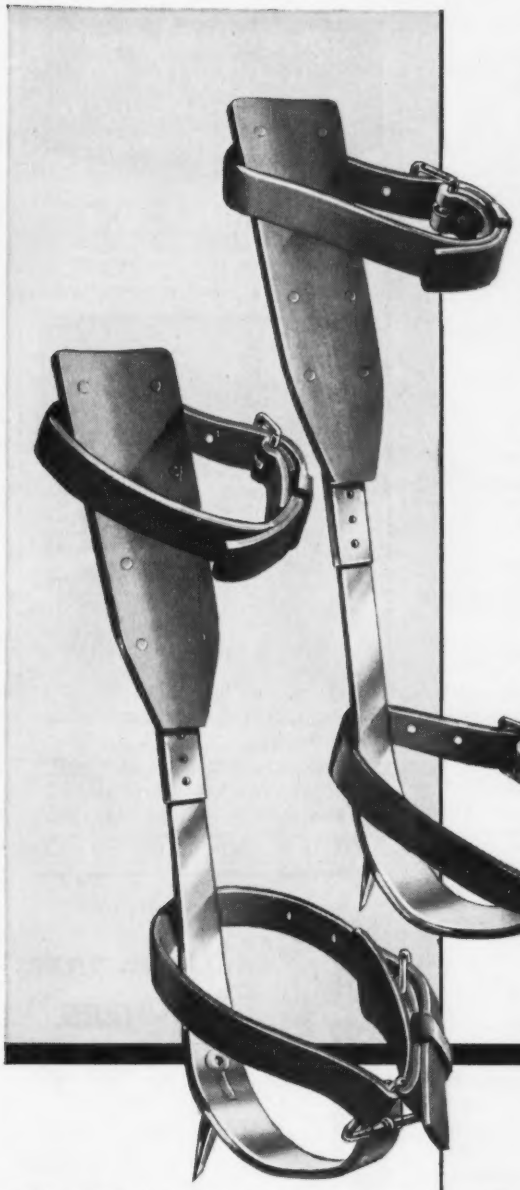
Cable Support Systems

Chalfant Splice Plates and Trays are securely fastened by the exclusive Chalfant Crimping Method . . . to reduce installation time way below conventional methods. Lower costs are also achieved with Chalfant systems because each splice plate and tray is made from high quality, longer lasting, economical Aluminized steel.

You'll save 15% on material and 40% on installation when you use Chalfant Systems to produce a better job.

Write for Catalog

CHALFANT PRODUCTS CO., Inc.
11531 MADISON AVENUE
CLEVELAND 2, OHIO



WHY LINEMEN RELY ON KLEIN CLIMBERS

There is no piece of equipment more important to a lineman's safety than his climber. Klein pioneered in the development of the climber back when the first wires were strung, and today Klein climbers are preferred because of their safety design, built-in comfort and wide range of styles to suit every preference.

Whether it is a replaceable gaff, adjustable climber or fixed length climber . . . with riveted ankle loop or triangular ring . . . you will find it listed in the Klein Catalog. For convenience, all adjustable climbers may be obtained complete with straps and pads.

Klein adjustable climbers may be had with replaceable gaff—matched pairs, right and left.
1958-AR with riveted ankle loop.
C-1958-AR as above, complete with straps and pads.
1959-AR with triangular ankle ring.
C-1959-AR as above, complete with straps and pads.

WRITE FOR:

- Bulletin 458, showing manufacturing and testing details.
- Bulletin 154, Proper Sharpening of Climbers.

Fixed length and other patterns of climbers available. See the Klein Catalog.

Adjustable "Pole Master" climbers. Matched pairs, right and left. Fixed gaff.
1945-A with triangular ring at ankle.
C-1945-A complete with straps and pads.
1957-A with riveted ankle loop.
C-1957-A complete with straps and pads.

The famous Klein adjustable climber accepted as standard by many utility companies. Interchangeable right and left.
1901-MA with riveted ankle loop.
C-1901-MA complete with straps and pads.
1956-A with triangular ring at ankle.
C-1956-A complete with straps and pads.

ASK YOUR SUPPLIER

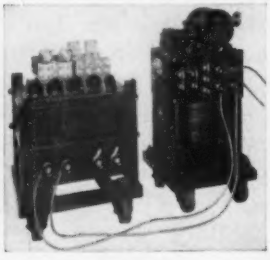
Foreign Distributor: International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
INCORPORATED
7200 McCORMICK ROAD, CHICAGO 45, ILL.

CIRCLE 123 ON READER SERVICE CARD

DO YOU
HAVE TROUBLE
getting sufficient
current when testing
CURRENT
TRANSFORMERS ?

The States Design helps get more current **at the test point**—offers smooth, quick adjustment of current to full capacity of Form "CTT" outfits which are made in 1000, 2500, 5000, 6000 and 10,000 ampere capacities.



Portable Type Form "CTT" Loading Outfit. 4000 ampere capacity. See Cat. 1, Sec. 3G1.

THE STATES COMPANY
3 New Park Ave., Hartford, Conn.

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FEDERAL SAVINGS ASSOCIATION

pays you 4½% on savings

DIVIDENDS PAID QUARTERLY at 4½% current annual rate • World-wide savings service for 170,000 individuals, corporations, and trusts in 50 states, 73 foreign countries • Same, sound management policies since 1925 • $38,000,000 reserves • Resources over $600,000,000 • Accounts insured by Federal Savings & Loan Insurance Corp. • Man and wife can have up to $30,000 insured • Funds received by 10th, earn from 1st • We pay air mail both ways

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More Literature

(Continued from page 122)

discussed and explained with line drawings and dimension charts. Brochure No. P81-5, 12 pages. Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio. **(159)**

SAFETY

FIRE EXTINGUISHING EQUIPMENT . . . the Cardox, for power plant fire protection systems. Folder, six pages. Cardox, Div of Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill. **(160)**

SAFETY EQUIPMENT . . . asbestos gloves, first aid equipment and many other essential safety items. All styles are fully indexed and well illustrated. Safety Catalog. Advance Glove Mfg Co, 901 W Lafayette Blvd, Detroit 26, Mich. **(161)**

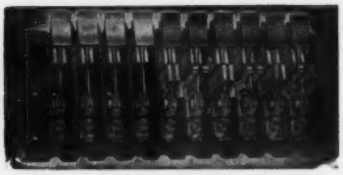
STORES & SHOPS

CABLE MEASURER . . . the CBL cable measuring unit, consisting of large cable reels which can be mounted on the RL31 Reelift for pulling through the HCM cable meter and onto the collapsible take-up reel No. 480. Adjustable floor stand is part of the unit. Catalog includes descriptions and photos of other reels, a wire meter for mounting on wall, post or counter, and a collapsible reel and spool winder. Catalog, eight pages. HyKon Mfg Co, 163 E State St, Alliance, Ohio. **(162)**

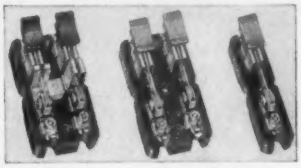
REFERENCE . . . to electrical products, excluding only appliances and electronic items. Twenty-three product classifications with 71,370 product descriptions and listings and 10,315 illustrations. Will be published on a semi-annual basis, with the 1961-62 edition ready for distribution in Sept. 1961. Pre-publication orders are now being taken. Catalog, 792 pages in either cloth-bound or

Make sure your
TEST SWITCHES
have the exclusive
STATES features

- New Safety Grip Handle assures safer, easier gripping.
- No live parts extend beyond base.
- Maximum pressure at jaw contacts.
- Large Selection of pole arrangements.
- Nickel corrosion-resisting finish insures good contact, attractive appearance.



"SMK" TEST BLOCKS. Solid base type. Over 2,000 combinations of pole arrangements.



UNIT TYPE TEST BLOCKS
Wide variety of elements

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3 New Park Ave., Hartford, Conn.

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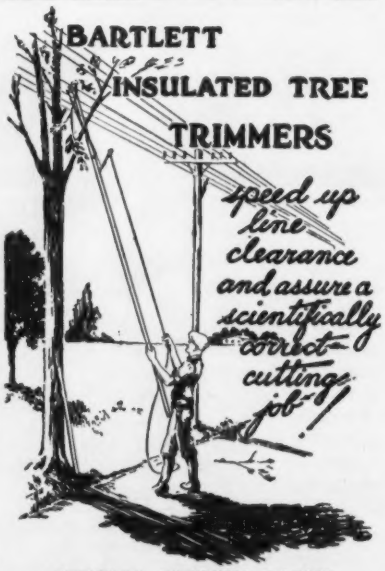
INSULATED TREE
TRIMMERS



SPECIAL UTILITY SAWS

Complete line of hand saws. Illustrated is 124-B with 24-in. blade, with fast-cutting teeth 4 points per inch. Combines fast, smooth cutting. Send for catalog No. 41.

BARTLETT MFG. CO.
3048 E. Grand Blvd. DETROIT 2, MICH.

CIRCLE 48 ON READER SERVICE CARD

simulated-leather edition. Jaqua Electrical Catalog Div, 124 Fair St, S E, Grand Rapids 2, Mich. **(163)**

FORK LIFT TRUCK . . . specifications and operating characteristics of the heavy-duty Sitdrive Model C Spacemaker electric fork lift truck, available in 30 models and capacities to 4,000 lb. The Inchomatic drive control systems which permit exact inching and load spotting are also described. Circular 32B, six pages. Lewis-Shepard Products Inc, Dept R11-14, 125 Walnut St, Watertown 72, Mass. **(164)**

TRANSFORMERS

RADIATORS . . . for transformer cooling. New line of plate-type radiators said to be up to 40% lighter in weight than conventional radiators. Complete dimensional and weight data; also heat transfer surface provided for a wide range of sizes and styles suitable for distribution transformer and small power transformer cooling. Bulletin No. FR-61, four pages. Flexoplate Div, Tranter Mfg, Inc, Lansing 9, Mich. **(165)**

TRANSFORMERS . . . distribution, single and 3-phase, 167/187-500/560 kva, 15 kv and below, for commercial and industrial distribution. Permalex units feature as much as 23% weight reduction, as much as 25% reduction in height, and 12% greater kva capacity. Pole-type are equipped with hangar brackets. Bulletin GEA-7153, 12 pages. General Electric Co, Schenectady 5, N. Y. **(166)**

DETECTOR RELAY . . . for monitoring gas and warning of incipient and sudden faults in completely oil-filled power transformers. Gas detector relay and the Type J fault pressure relay are combined to give over-all fault protection. Gas generated by the fault rises into the relay to actuate an alarm when 200 cc of gas has accumulated. Both relays can be used with the constant-pressure, maintenance-free Atmoseal oil preservation system. Bulletin GEA-7124, two pages. General Electric Co, Schenectady 5, N. Y. **(167)**

(More Literature on page 126)

THIEL

TRANSFORMER HANGERS

● Thiel Hangers are made to NEMA specifications. Heavy gauge steel construction, hot-dip galvanized for dependable service and long life. Two styles complete with galvanized bolts and nuts stocked for immediate shipment.

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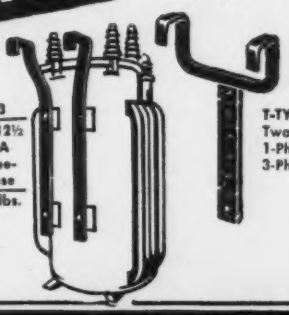


MODEL	C-1	C-3
Transformer	75-100 KVA Single-Phase	75-112½ KVA Three-Phase
Weight	46 lbs.	100 lbs.

T-TYPE HANGERS
Two sizes, for 3-50 KVA 1-Phase and 9-45 KVA 3-Phase transformers.

HANGER KICKERS
Sizes to fit T-Type hangers.

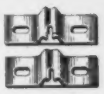
FASTENERS
For Electricians
Refrigerator Men
Plumbers
Pat. No. 2632356

EASY-ON STRAPS

New "Grip Type"-Snaps on

Electrical Fasteners That Hold ● ●

EASY-DRIVE
"NAIL-IT" STRAPS
New Hump
Pat. No. 2885169
Will not break or Pull out.



#545 C Adapter Plate-Upper
#546 C Adapter Plate-Lower
167 KVA Transformers

#260 CLEVIS
PRIMARY HUMPED SIDES
For 4,000 Volt or Medium Voltage Primaries at Dead Ends.

DEAD END EXTENSION BRACKET WITH #240 CLEVIS
Dead End Primary at Pole. Withstands 3,000# load maximum. Uses a minimum of space on pole.

SECONDARY CLEVIS #240
For use with Secondary Extension Bracket or Direct Pole mounting.

THIEL TOOL & ENGINEERING CO., INC.
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CIRCLE 49 ON READER SERVICE CARD

'Life Guard' Hats & Caps

The best in head protection for electrical/construction workers

Jackson's 'Life Guard' safety hats and caps safely resist over 20,000 volts, and they also provide impact resistance to more than satisfy federal requirements for safeguarding construction workers.

'Life Guard' safety caps have narrow brim around sides and back, visor in front. Injection molded plastic is strong yet flexible, has a soft comfortable feel. Caps may be ordered with attached welding helmets, goggles, and assorted face shields.

'Life Guard' safety hats offer neck protection with wide brim all around. The 'Life Guard' headgear is instantly adjustable in hat sizes, and its comfort keeps the hat where it does its job, on the worker's head. Chin straps and warm winterizers are available.

Standardize on this all-purpose safety hat for maximum head protection. Identify work categories by issuing these different hat colors: white, yellow, grey, and orange.

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AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

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CIRCLE 125 ON READER SERVICE CARD

More Literature

(Continued from page 125)

TRANSFORMERS . . . pole-type, distribution, 167 kva and smaller, 1.5 kv and below. General information, operating and maintenance tips, including tables and charts. Transformer Tips, 61X-9659, 52-page pocket manual. Allis-Chalmers Manufacturing Co, Milwaukee 1, Wis. **(168)**

TRANSMISSION

EHV LINE PROTECTION . . . protective products and correlated programs of laboratory and field testing for power projects transmitting extra high voltages. Explains how to employ combinations of new transmission hardware to control power losses from corona, minimize interference with radio and TV, and eliminate conductor damage from stress concentrations at suspension points and from line slapping at midspan points. "Planned Line Protection for EHV," eight pages. Preformed Line Products Co, 5349 St. Clair Ave, Cleveland 3, Ohio. **(169)**

STRINGING EQUIPMENT . . . for conductors: spacer-type aerial cable blocks; bundle conductor stringing blocks; lightweight, all-aluminum blocks; and helicopter stringing blocks. Also new Flowing Arch Groove design for stringing very large single conductors. Photographs of products on the job, as well as complete dimensional and working load information. Catalog 611, 36 pages. Sherman & Reilly, Inc, Chattanooga 2, Tenn. **(170)**

Why you can be sure Lamplighter offers long use and low cost.

BECAUSE the design of this new photoelectric control offers every industry need for roadway lighting in one unit.

BECAUSE standards committees everywhere have tested Lamplighter alongside other similar devices giving Lamplighter a well-earned "approved" stamp.

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BECAUSE Lamplighter is constructed of prime component parts.

BECAUSE Lamplighter *does* cost you less and because maintenance is minimal.

We have the right answers and the right product for *your* automatic lighting needs. Write —

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Utility Products Division, Dept. MP-1B
New Haven 14, Connecticut

LAMPLIGHTER
photoelectric lighting control

126 CIRCLE 126 ON READER SERVICE CARD

Whether a Winch Line Hook or a complete Line Body check your requirements with

UTILITY TOOL & BODY CO.
CLINTONVILLE, WISCONSIN

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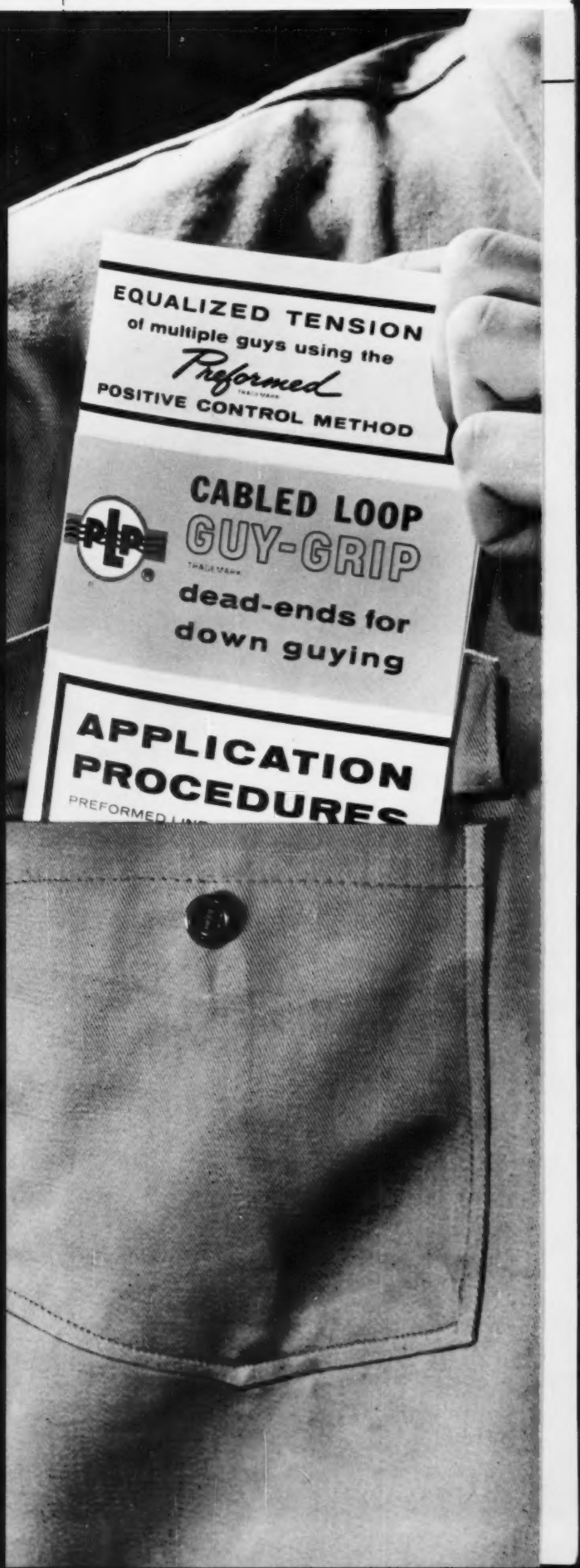

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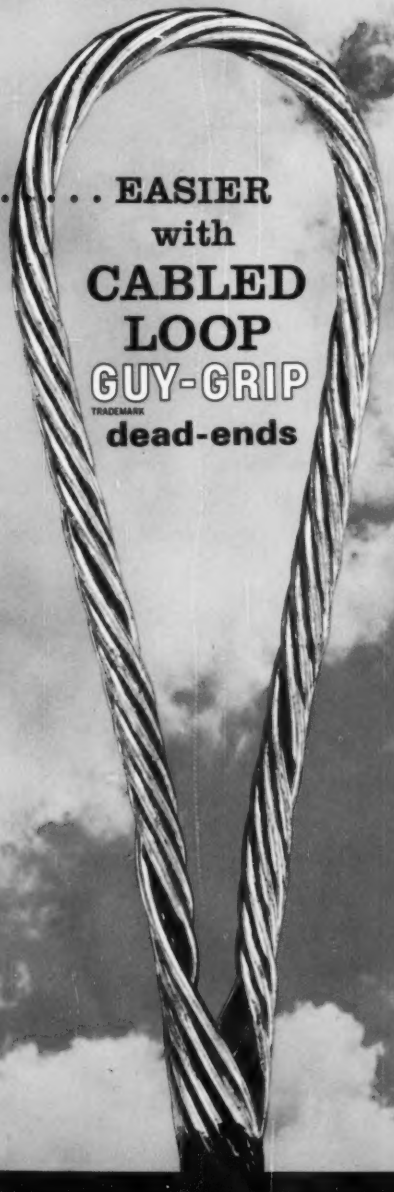
POSITIVE CONTROL METHOD

Write today for the new pocket-sized application booklet, or the file-sized brochure, covering *complete guying procedure* with the CABLED LOOP GUY-GRIP dead-ends.

Just follow these key

① Tension the new guy until the existing guy goes slightly slack —then cut the strand about 3" above the rod eye, and align the loop of the GUY-GRIP dead-end and the rod eye.

② Wrap one leg of the GUY-GRIP dead-end onto the strand several turns (as far as the *second* cross-over mark).



EASIER with CABLED LOOP GUY-GRIP TRADEMARK dead-ends

PREFORMED LINE PRODUCTS COMPANY

5349 St. Clair Avenue
Cleveland 3, Ohio · UTah 1-4900
600 Hansen Way
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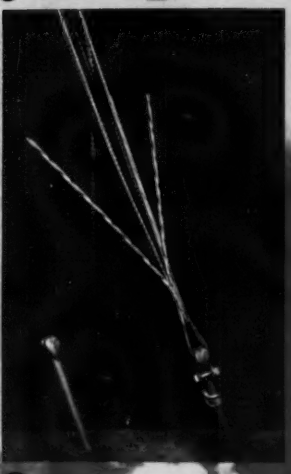
PLP® is a trademark which is registered in the U.S. Patent Office and is the property of Preformed Line Products Company.

You can look up to Preformed TRADEMARK

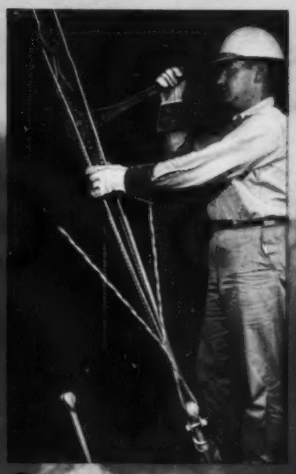
CIRCLE 129 ON READER SERVICE CARD

y steps...

(shown here by a PREFORMED demonstrator)



③ Similarly wrap on the second leg of the GUY-GRIP dead-end as far as the second cross-over mark.



④ Back off the hoist until both guys are even. Complete the application of the GUY-GRIP dead-end to the strand. Repeat these steps for additional guys...

⑤ ...and you're sure the tension is equalized.

CABLED LOOP GUY-GRIP™ dead-ends

SAFEST, FASTEST, and MOST ECONOMICAL method of multiple or single guying

- Easiest for all joint pole construction.
- Compatible materials.
- Easier guying with *high strength strands* — no strand bending required.
- No concentrated stress on strand.
- Less pole rake required.

The product in this advertisement is manufactured under one or more of the following: U.S. Patent No. 2,691,865 and 2,761,273; other patents pending.

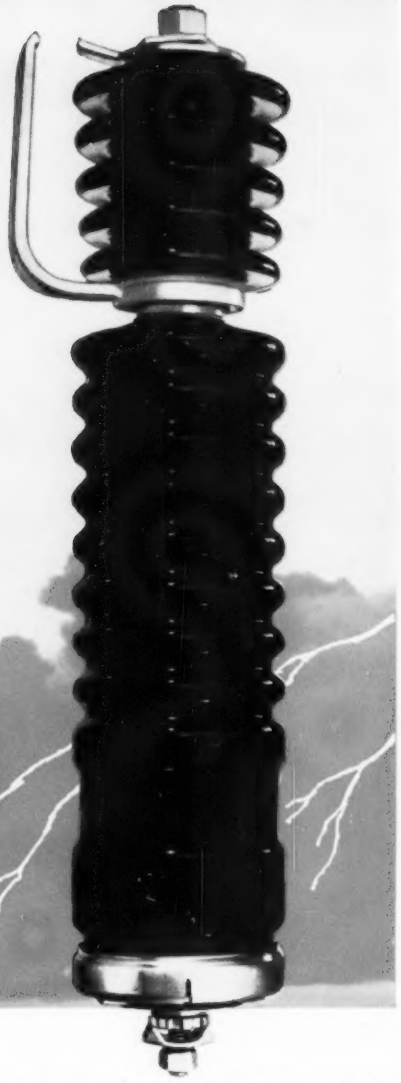
Only the new

KEARNEY

UNIGAP

DISTRIBUTION VALVE LIGHTNING ARRESTER

offers you the important ***EXTRA*** *of* UNSURPASSED DURABILITY VERIFIED BY A NEW CONCEPT OF ACCEPTANCE TESTING!



The exceptional durability and protective characteristics of Kearney Unigap Distribution Arresters have been thoroughly proven in an exhaustive program of service condition acceptance testing far more rigorous than present standards.

During this program, conducted at the Hubbard-Kearney Electrical Research Laboratory, Unigap arresters were subjected to unusually severe tests simulating actual service conditions and conclusively proved their capability to withstand some of the most severe conditions liable to be encountered in service. Unigap also proved to be the **only** arrester capable of successfully withstanding this complete series of acceptance tests.

Unigap Arrester durability and performance characteristics far exceed standards . . . discharge ability exceeds station arrester requirements . . . follow current interrupting ability is ten times normal service requirements.

Consistently low sparkover and permanence of characteristics are insured by "unitized" spark gap construction combining both gap and separate coil functions in one rigid, precision assembly. Rapid magnetic arc movement and power follow current are accomplished without an auxiliary coil. An improved valve element limits power follow current to values perfectly matched to the interrupting ability of the gap structure.

For published results of Unigap acceptance tests and full information about this outstanding arrester, contact your Kearney Representative

510

KEARNEY **JAMES R. KEARNEY CORPORATION** • 4236 Clayton Avenue • St. Louis 10, Missouri

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Holan to Train Utilities in Live Line Techniques

Holan Corp, headquartered in Cleveland, Ohio, announced recently that the authorized and qualified Holan Live Line Bare-Hand Team will make a coast-to-coast tour of electric utility companies to demonstrate and train crews in a new technique (EW, Dec. 19, 1960, p 76) for working bare-handed on energized high-voltage lines.

The revolutionary new concept was announced at the end of 1960 by the American Electric Power System. It had been developed by H. L. Rorden, high-voltage practices engineer for the American Electric Power Service Corp. Rorden and Ohio Brass Co engineers under the direction of Dr Charles J. Miller Jr supervised the research and testing. All tests were conducted at the High-Voltage Laboratory of the Ohio Brass Co, parent company of the Holan Corp.

Holan pioneered the equipment used in the tests of the new technique—the Holan Elbow (insulated aerial lift) and metal mesh shielding—and has been granted exclusive rights to manufacture, sell and license the shielding by Rorden.

The two-man Holan team was specially trained. Its tour will start in April and is expected to last several months. Holan officials and Rorden said that tremendous interest was created and that many requests for basic information on the new technique following the initial announcement had been received. This prompted training the team and scheduling the tour.

The bare-hand method, which has been heralded as one of the most outstanding developments in maintenance in the history of the electric power industry, requires proper training and special equipment. The Holan team will teach safe practices to utility personnel, explain the equipment, and demonstrate through certain job applications the basics of the new method.

Holan officials are working out an itinerary for the Holan Live Line Bare-Hand Team and utility executives are urged to contact Holan Corp, Cleveland 35, Ohio, so that convenient area demonstrations can be scheduled.

Two-Cycle ACB Field Tests Are Successful

The world's fastest operating air-blast circuit breakers harmlessly extinguished in less than two cycles the highest currents ever interrupted on field tests for 138-kv equipment.

On April 8 and 9 the breakers successfully interrupted 40,000 amp at the American Electric Power System's Philip Sporn Plant substation, New Haven, W. Va.

Maximum clearing time for the tests did not exceed approximately 1.8 cycles. Industry standard is three cycles for conventional dead-tank breakers.

The two-cycle, 138-kv air-blast breakers, manufactured by GE's High Voltage Switchgear Department, Philadelphia, Pa., were put through rigorous tests for transmission line faults and bus faults, both grounded and ungrounded.

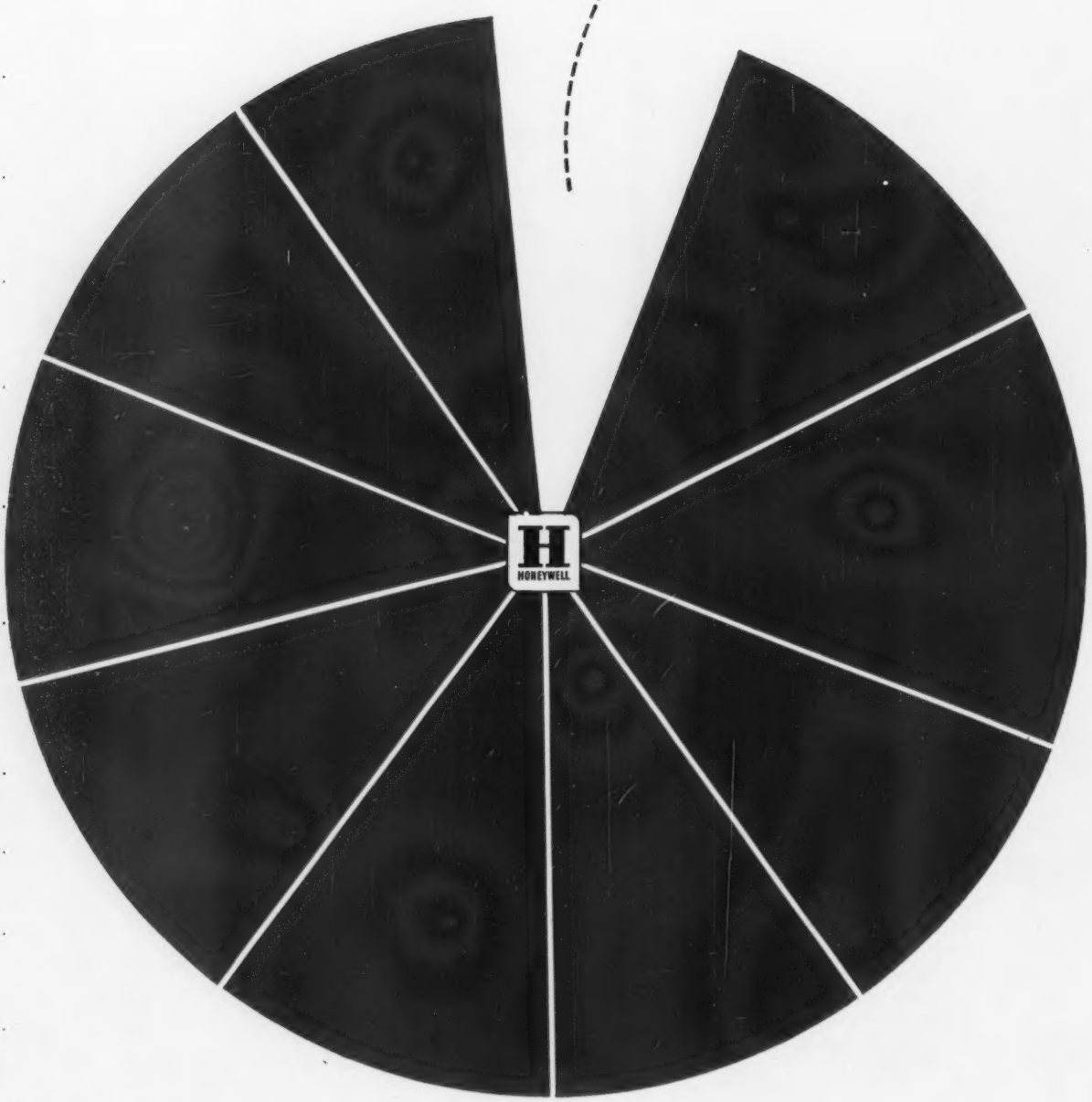
American Electric Power Service Corp and GE engineers co-operated to conduct a comprehensive series of tests on the equipment. Power interruption tests with line faults ranging from 9,100 through 40,000 amp were carried out to prove the breaker's capability to interrupt faults within two cycles, officials said.

The 138-kv, 1,600-amp breaker was subjected to a series of close-opening tests on grounded and ungrounded faults. A total of nine faults were interrupted, ranging from 2,800 Mva through 9,930 Mva.

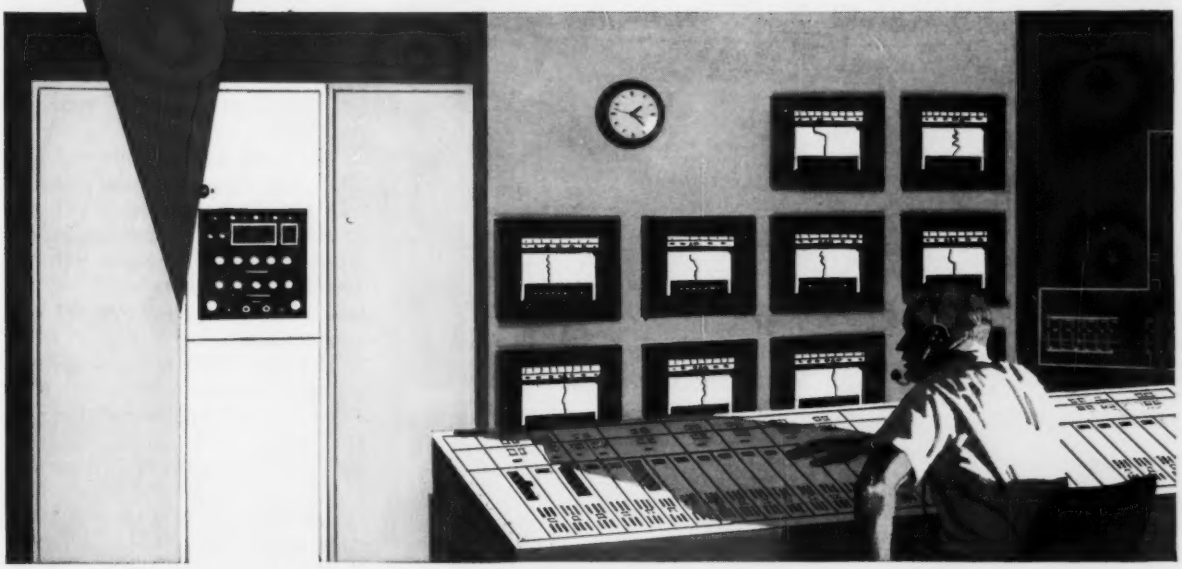
Test engineers present inspected the interrupter contacts after the tests and said they were in excellent condition.

(*More News of Manufacturers, p* 136)

A COMPUTER IS ONLY



PART OF ECONOMIC DISPATCH CONTROL



You hear a lot about computer-controlled load-frequency systems these days. As systems get bigger, faster and more complex, computers are being used as the reins as well as the brains—for control as well as data reduction.

The Big Picture. But like the human brain, a computer cannot work independently. It must receive raw information from sensory instruments. Where automatic control is involved, it must transmit its logic to "muscle" instruments which translate decisions into action. The computer is part of a system, and, like the human body, the system functions effectively only when all of its parts are perfectly coordinated. In Honeywell systems, this compatibility of *all* system components is built in, for all Honeywell instruments and controls are *made* to complement each other.

Industry Experience plus Computer Know-How. Equally important, a computer must be properly applied. Computers are "illiterate." They must be told what to do and how to do it by men who know. In engineering a computer-directed instrumentation system that will be precisely matched to your needs, Honeywell systems engineers draw on more than 75 years of measurement and control experience.

Single-Source Responsibility. Honeywell offers you a single contract covering your entire system. You get economy, convenience, simplified training of personnel, economical stocking of parts and accessories—*all* the advantages of single-source purchasing. And you get the only truly complete computer control package available from a single source.

MINNEAPOLIS-HONEYWELL, Pottstown, Penna. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

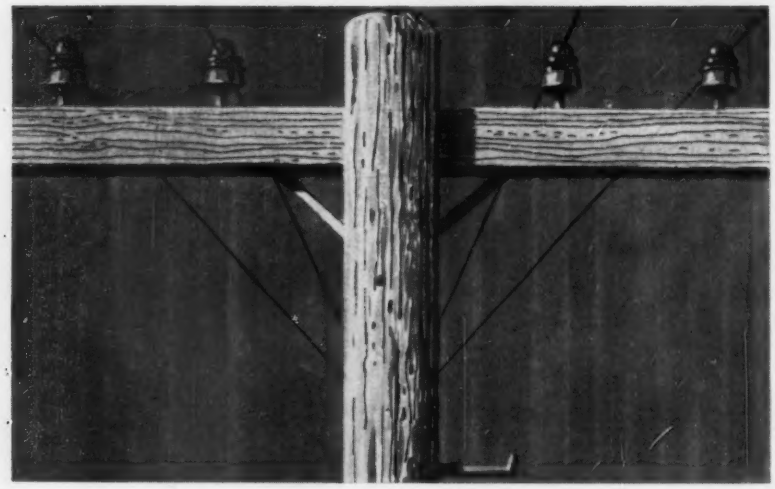
Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL Sales and Service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

transporting men?



...or electricity?

Ever tote up the costs of transporting your line crews to and from jobs? Of keeping crews standing by for emergencies? Of committing capital for expensive trucks and equipment? A qualified electrical contractor can probably do your line maintenance work at less cost to you. He offers:

- the skills and equipment you need *when and where* you need them
- precise cost accounting
- reduced truck and other equipment overhead
- fewer personnel headaches, firm job completion dates, and written performance guarantees

By doing his job well, a qualified electrical contractor frees you for your basic job—generating and transmitting electricity. For names of NECA contractors, write

NECA

National Electrical Contractors Association, 610 Ring Building, Washington 6, D. C.

Largest Oil-Filled BICC Cable Made for Toronto

The largest oil-filled cable yet made by British Insulated Callender's Cables Ltd for commercial operation has been manufactured to the order of the Hydro-Electric Power Commission of Ontario by BICC Power Cables Division, Erith Works, Belvedere, Kent. It is a single-core 230-kv cable and the 2.16-sq-in. conductor consists of six stranded segments laid 'round a central oil duct.

The cable has a reinforced lead alloy sheath and corrosion jacket of self-vulcanizing rubber, PVC and hessian tapes. Reinforcing bronze tapes, tinned to prevent galvanic action between the bronze and the lead alloy, are applied over the lead alloy sheath.

The new cable will provide two 3-phase circuits between Haig Junction and Applewood Junction in Toronto, each circuit being designed for operation at 230-kv with a rating of 540 Mva at 100% daily load factor and 680 Mva at 75% daily load factor with the adjacent circuit out of service.

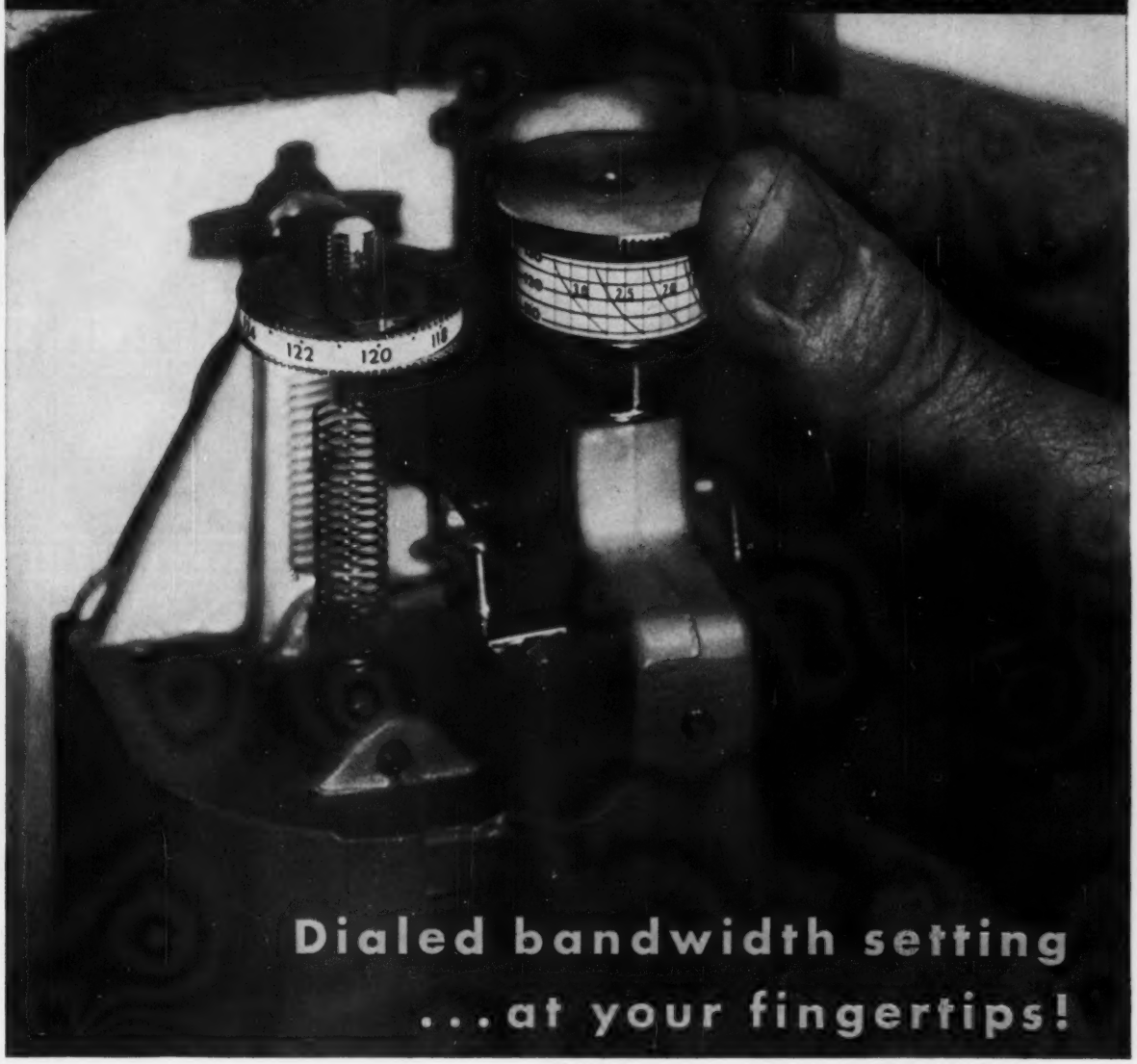
Laying of the cables will be direct in the ground without ducts and, in anticipation of a possible future load growth and an increase in the current-carrying requirements of the cable circuits, three ¾-in. dia polyethylene water pipes will be installed with each circuit for cooling purposes.

Continuous-Cast Bar-Steel Plant to Be Erected

Babcock & Wilcox Co announced recently the signing of an agreement to license the country's first experimental continuous casting steel plant for production-scale operation. The agreement was reached with the Roanoke Electric Steel Corp, Roanoke, Va., manufacturer of steel rods and angles.

To be operated on an experimental basis under regular production and product application conditions, the new plant is designed to cast square bars in the size range of 3 to 6 in. Completion of the facility is scheduled for the early part of 1962.

ANOTHER STEP AHEAD IN VOLTAGE REGULATION



New, exclusive G-E Micro-Band* relay permits fast, accurate setting of both regulator voltage level and bandwidth

Now, with General Electric single- and three-phase step voltage regulators, you can dial optimum voltage level *and* bandwidth *in seconds . . . with micrometer accuracy!*

This important new advantage results from G.E.'s exclusive Micro-Band voltage-regulating relay—the first in the industry to offer you a dialed calibration of *both* these vital adjustments.

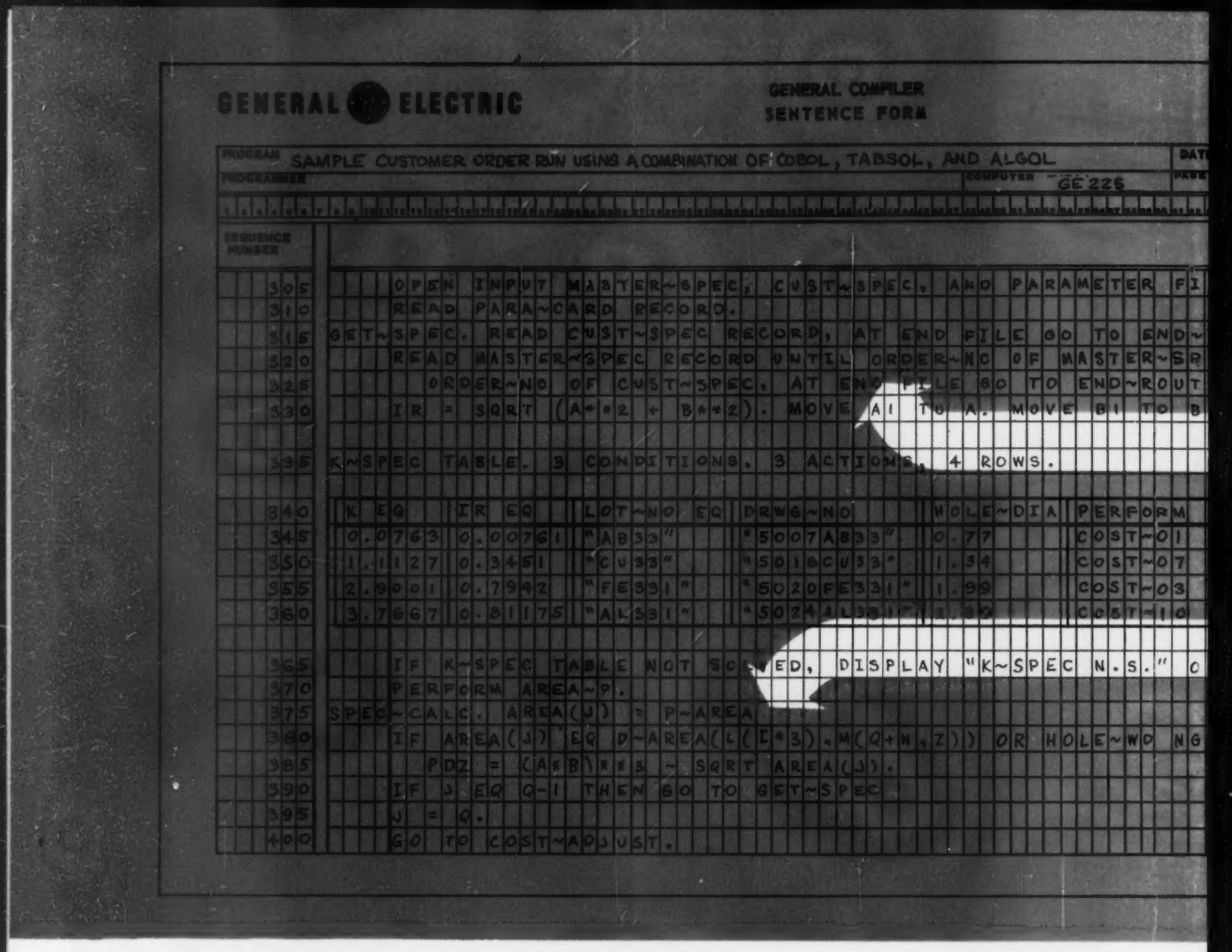
Micro-Band relay saves you time and money by eliminating the guesswork and painstaking procedures normally involved in making regulator adjustments. What's more, this *full* calibration permits precise coordination of voltage level and bandwidth setting with General Electric's highly flexible time-delay control. Thus, you take full advantage of the reduced bandwidths possible with General Electric regulators—bandwidths proven by recent computer studies to offer you increased system earnings at no sacrifice of regulator life.

Your General Electric regulator representative has complete information on the new Micro-Band relay and can show you how to achieve system savings through reduced regulator bandwidths. Call him today. Or write General Electric Company, Section 456-08, Schenectady 5, N. Y. *Voltage Regulator Products Section, Pittsfield, Mass.*

* Trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC



GENERAL ELECTRIC

GENERAL COMPILER
SENTENCE FORM

PROGRAM SAMPLE CUSTOMER ORDER RUN USING A COMBINATION OF COBOL, TABSOL, AND ALGOL
PROGRAMMER
COMPUTER GE 225

SEQUENCE NUMBER

```
305     OPEN INPUT MASTER~SPEC, CUST~SPEC, AND PARAMETER FI
310     READ PARA~CARD RECORD.
315 GET~SPEC. READ CUST~SPEC RECORD, AT END FILE GO TO END~
320     READ MASTER~SPEC RECORD UNTIL ORDER~NO OF MASTER~SP
325         ORDER~NO OF CUST~SPEC. AT EN  FILE GO TO END~ROUT
330     IR = SQRT (A**2 + B**2). MOVE AI TO A. MOVE BI TO B

335 K~SPEC TABLE. 3 CONDITIONS. 3 ACTIONS. 4 ROWS.

340 | K EQ | IR EQ | LOT~NO EQ | DRWG~NO | HOLE~DIA | PERFORM |
345 | 0.0763 | 0.00761 | "AB33" | "5007AB33" | 0.77 | COST~01 |
350 | 1.1127 | 0.3451 | "CU33" | "5010CU33" | 1.34 | COST~07 |
355 | 2.9001 | 0.7942 | "FE331" | "5020FE331" | 1.99 | COST~03 |
360 | 3.7667 | 0.81175 | "AL331" | "5024AL331" | 2.30 | COST~10 |

365     IF K~SPEC TABLE NOT SO  VED, DISPLAY "K~SPEC N.S." O
370     PERFORM AREA~P.
375 SPEC~CALC. AREA(J) = P~AREA.
380     IF AREA(J) EQ D~AREA(L(L**3), M(Q+N, Z)) OR HOLE~WD NG
385         PDZ = (A**B)**3 ~ SQRT AREA(J).
390     IF J EQ Q-1 THEN GO TO GET~SPEC.
395     J = Q.
400     GO TO COST~ADJUST.
```

GECOM...A UNIQUE CONCEPT IN

now available in the GE 225 ... and future General Electric general-purpose computers.

- processes COBOL, ALGOL and TABSOL*
- all problem statements easily read and understood
- extended usage... re-programming unnecessary
- programs produced faster... more efficiently

GECOM—the first truly GENERAL COMPILER SYSTEM—introduces a fresh, versatile approach to computer communication. Developed for the GE 225 computer, the GENERAL COMPILER *makes available all of the various proved programming techniques in one consistent, compact package.* No longer is it necessary to learn a dozen different programming systems to handle a full range of jobs effectively—each job is approached in *exactly the same way*, be it formula evaluation, a sort, or even a payroll. The language for describing any run is *consistent*, operating procedures and programming are *standard*, and documentation is readable and easily *understood*.

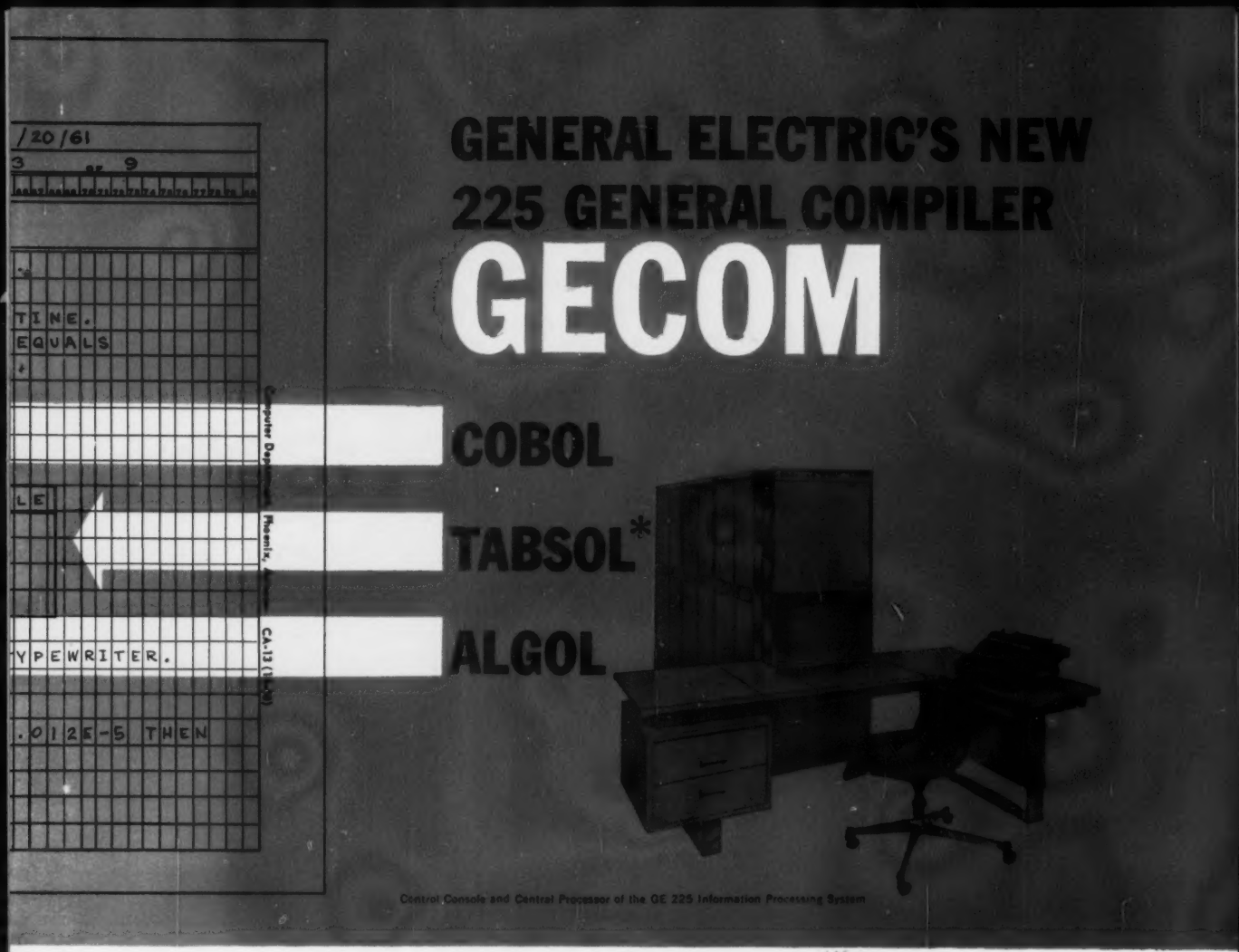
*A General Electric Trademark

THE GENERAL COMPILER PROVIDES—

A FAMILIAR LANGUAGE STRUCTURE—Problems need not be stated in machine code. The GENERAL COMPILER processes English language statements (COBOL), Algebraic expressions (ALGOL), and Structure Tables (TABSOL). It permits you to use all or any one of the computer languages... as your needs require. Still, you have available the capability to expand, use other languages and new techniques as your needs change.

A PROVED, ACCURATE CODER—Data Description and Problem Logic may be written in one, two, or a combination of the available languages producing a machine program of efficient, effective coding. Since the machine coding is derived directly from the logic of the problem statement, it is only at the logic level that debugging may have to be done.

A STANDARDIZED, UNDERSTANDABLE DOCUMENTATION—Because GENERAL COMPILER problems are written in familiar languages, they can be easily read and under-



Control Console and Central Processor of the GE 225 Information Processing System

COMPUTER COMMUNICATION

stood. In addition, problem format provides a high degree of standardization. Programs written for today's machines in GECOM format can be used for future General Electric computers—eliminating the need for re-programming.

AN EFFICIENT, ECONOMICAL USE OF COMPUTERS—Personnel training time and expense are sharply reduced since the novice programmer may use the familiar terminology of his profession. Manual coding is eliminated and debugging cut to a minimum. Thus, a machine program may be produced much faster and more efficiently than by present manual methods.

THE GENERAL COMPILER IS ANOTHER GENERAL ELECTRIC FIRST!

For more detailed information, write today for brochure CPB-144 on the new General Electric General Compiler. Also available: brochure CPB-101 on the GE 225 Information Processing System and CPB-81 on the GE 210 Data Processing System.

Write to: General Electric Company • Computer Department • Section 60F4 • Phoenix, Arizona.

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INFORMATION PROCESSING AUTOMATED BY GENERAL ELECTRIC

General Electric—Pioneer in computer systems for all phases of business, industrial, scientific, engineering and financial endeavor.

Progress Is Our Most Important Product

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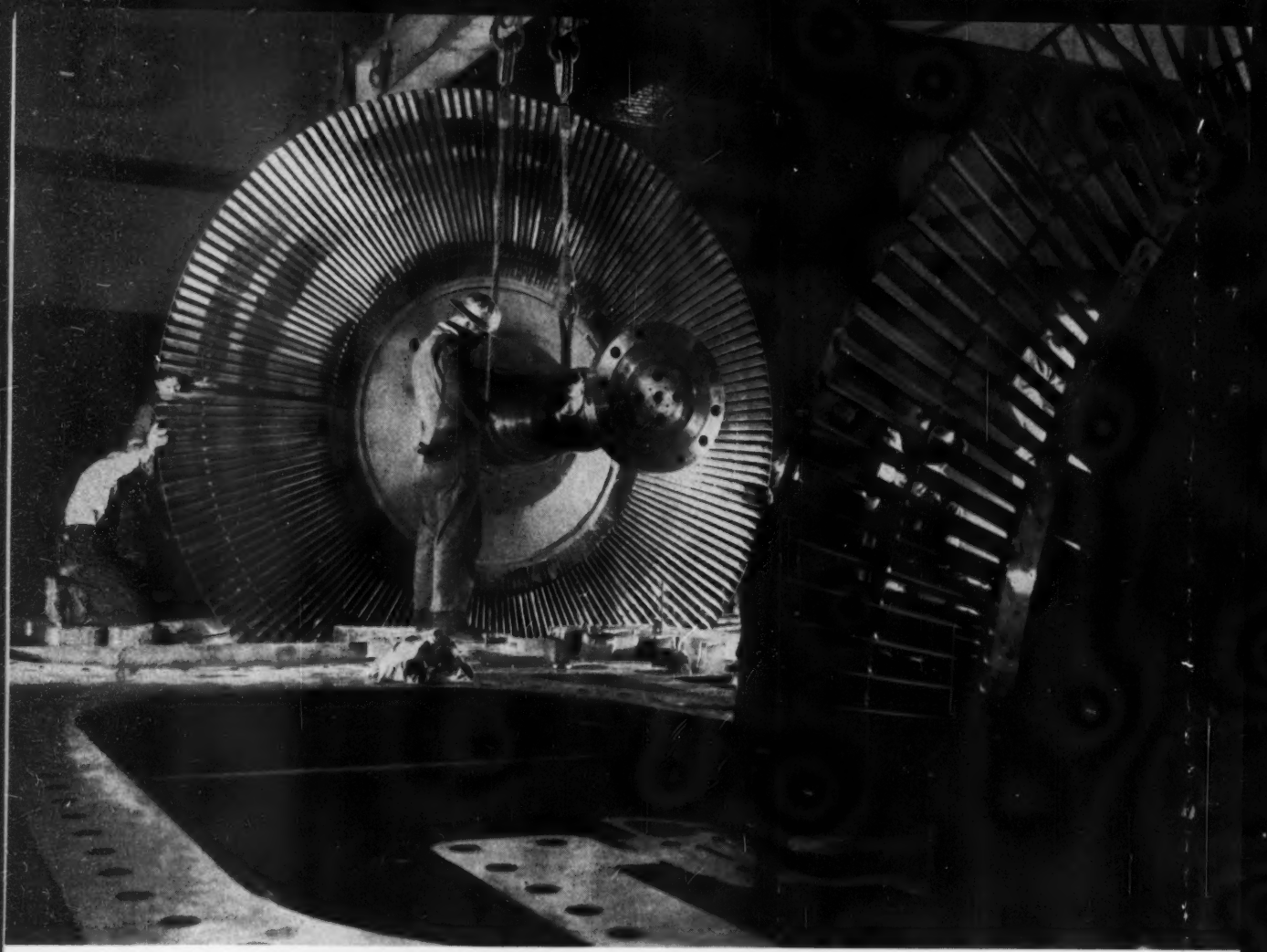
CPA-60(4/61)



Prompt, personalized service at your plant, in one of our service shops, or at the world's finest turbine-generator manufacturing facility . . . is part of your General Electric turbine-generator.

Priority repair for your General Electric turbine-generator starts with its pedigree

When General Electric ships your turbine-generator, part of it stays behind.

We keep its pedigree—a permanent record of engineering and manufacturing specifications, inspection reports, and other pertinent data. And we keep it up-to-date.

Then, whenever repairs are needed, our experienced turbine-generator service teams refer to the pedigree, promptly analyze the trouble, and set up a program of priority repair. Your unit is given top priority handling on a personal basis—utilizing the extensive technical know-how, materials, resources, and manufacturing facilities available at General Electric.

Thus, your turbine-generator's pedigree is an integral part of General Electric's priority service program—a program designed to put your turbine-generator back on the line in the shortest time possible. 244-07

Progress Is Our Most Important Product

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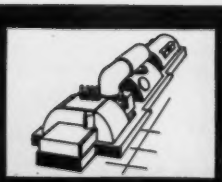
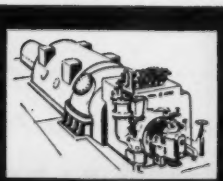
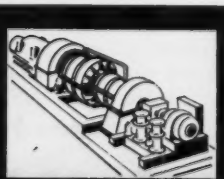
General Electric Turbine-Generators Help Keep Power Costs Low



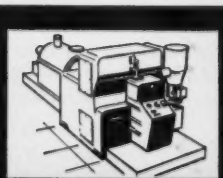
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles



Mechanical drive steam turbines for auxiliaries

Electrical World

APRIL 24, 1961

Management Newsletter

Just What Do Commissions Want?

Accounting once seemed to be a quiet profession, not nearly as appealing to a boy of seven as being a fireman, or, nowadays, a rocket scientist. But the image of the quiet, methodical bookkeeper, if ever it bordered on truth, was erased by the Internal Revenue Code of 1954. Since then, accountants have become fighting men, generally fighting with other accountants. And for utility controllers, much of the verbal bloodshed centers about the harmless-looking little phrase, "flow-through."

Flow-through wasn't an issue prior to 1954. Until then, most depreciation was taken by the straight-line method, and with the exception of emergency war-time procedures, over the age-life of the equipment. But the 1954 Code allowed other methods of writing-off property. Declining balance, and sum of the years-digits methods were specifically given the green light, and other methods were allowed which achieved similar results. In addition, the government allowed all facilities related to national defense to be written-off over 60 months.

The result of these new systems was that a company was able to deduct a large part of the cost of an asset in the earlier years of its use, or, to put it another way, to recover the bulk of the expense of a project much more quickly than would otherwise have been possible. At this point the problem was thrown to the accountants. What do you do with the funds made available by the faster

write-offs? It was then that flow-through became an issue.

The flow-through school seems to hold the viewpoint that liberalized depreciation actually constitutes a reduction in taxes. A clear statement to this effect comes from the Interstate Commerce Commission which argues that, "When an available depreciation allowance produces a reduction in federal income taxes, no matter how temporary the benefit may be, the effect on net income should be the same as a reduction in taxes produced by lower tax rates." With this as a starting point, it follows that liberalized depreciation or accelerated amortization means a reduction in costs. Hence, flow-through fans will allow only actual taxes to be taken as an operating expense. The benefit of the bigger write-off then flows through to surplus.

On the other side of the fence are accountants who favor normalization. This

Summary of Rate Treatment

Regulatory Body	Normalization			Flow-through	Final Court Tested †
	F	RB	RR		
FPC	X				YES
Alabama		X			
Florida	X				
Georgia		X			
Hawaii		X			
Illinois		X			YES
Indiana			X		YES
Kansas			X		
Kentucky		X			
Louisiana	X				
Michigan			X		
Nevada	X				
Oklahoma	X				
Oregon			X		
Wisconsin		X*			
Wyoming	X				
California				X	
Colorado				X	
Connecticut				X	
District of Columbia				X	
Maine				X	YES
Missouri				X	
New Hampshire				X	
New Jersey				X	
New Mexico				X	
New York				X	
North Carolina				X	
North Dakota				X	YES
Ohio				X	
Pennsylvania				X	YES
South Carolina				X	
West Virginia				X	

F — Full normalization.
RB — Accumulated balance sheet credits deducted from rate base.
RR — Effect of interest-free funds on capital costs considered in fixing rate of return.
* — Under the "Wisconsin Method," depreciation expense is charged with an amount equal to the tax differential and reserve for depreciation is credited. This is in addition to the normal charges and credits for depreciation.
† — No appeal taken.
Source: Stone and Webster Service Corporation

means that a company reports normal taxes under the straight line method as an operating expense even though it is paying lower taxes due to the more rapid depreciation. The normalizers argue that reduced taxes in the beginning of the period are balanced by increased taxes at the end of the period. There is no real tax reduction. The American Institute of Certified Public Accountants expressed this concept in its Accounting Research Bulletin 44. The Institute recommended that companies using liberalized depreciation recognize the tax being deferred by providing for the taxes that will have to be paid when the benefits of accelerated depreciation have expired. Later, the Institute released a statement dated April 15, 1959, saying that a deferred tax account should not be construed to be earned surplus or stockholder equity.

It's extremely important to the utility which philosophy the commissions adopt for rate-making purposes. If they go to flow-through then surplus will be increased by the reduced taxes reported. This money could be available to stockholders, but it is quite possible that the commission will be more concerned with making it available to customers in the form of lower rates. On the other hand, if the commission leans to normalization, utilities report a normal tax. This means the benefit of the quick write-off never gets to surplus but rather ends up either in a reserve account or in an appropriated surplus where it is still of benefit to the company.

Which Way Are the Commissions Moving?

A recently completed publication by Stone & Webster Service Corp gives a thorough rundown on the thinking of the regulatory bodies. Some commissions insist on flow-through. Others normalize. Some do a little of each. And under each category there are several sub-sections. The Stone & Webster survey not only shows where the different state commissions stand, but it also summarizes the viewpoints that have led to their positions. Here's what they've said:

FAVORING NORMALIZATION

The Federal Power Commission favors normalization. In a hearing on the Amere Gas Utilities Co, the FPC said, "The argument that the sums in the reserve account will rightfully belong to the ratepayers, or that the ratepayers will bear any burden that they do not now bear by reason of the creation of the reserve is wholly erroneous." The commission maintained this position in hearings concerning the El Paso Natural Gas Co, but stated that it might reflect the favorable effect of the reserve on the cost of money and hence on the rate of return. The Fifth US Circuit Court of Appeals, ruling on the same case, held that there was a tax deferral rather than a saving, and added that if flow-through were used, a company would not be entitled to a rate increase to pay higher taxes in later years. In the Northern Natural Gas Co hearings, the FPC provided for a 1.5% return on deferred income tax accruals. The commission hoped that this rate would divide the benefits of liberalized depreciation between the company and the ratepayers, giving the major benefit to the ratepayers, and giving the utility only so much of the benefits as is necessary to encourage the use of liberalized depreciation.

The Securities & Exchange Commission stated that effective April 30, 1960, any statement which carried accumulated credits arising from liberalized depreciation or accelerated amortization into surplus would be regarded as misleading even though notations were made, or the word restricted was attached to that portion of the surplus. On Jan. 16, 1961, the Commission approved financial statements filed by Kentucky Power Co and its associated companies wherein accumulated reduction in federal income taxes was designated: "Accumulated Amount Invested in the Business Equivalent to Reduction in Federal Income Taxes Resulting from Accelerated Amortization and Liberalized Depreciation which is Recorded as Earned Surplus Restricted for Future Federal Income Taxes in Accounts Maintained Pursuant to State Regulatory Requirements."

Florida Public Utilities Commission, after hearings concerning the rates of the Southeastern Telephone Co, said that it has taken the position that deferred taxes are merely a deferred tax liability and not a tax saving. This view squelched municipalities that had complained that the commission failed to deduct reserve for deferred income taxes from rate base.

The Georgia Public Utilities Commission ruled in favor of normalization in a case involving the Georgia Power Co, and stated that the effect of this treatment is fair to the rate payer and to the utility investor, and is in conformity with generally accepted accounting principles.

The Commission in Illinois went to normalization in the Alton Water Co case after the state supreme court reversed itself and upset the verdict of a Circuit Court which insisted on flow-through. But the commission added to its decision that "funds generated by accruing deferred tax expenses, and any facilities financed out of these funds, must be excluded from the rate base."

FAVORING FLOW-THROUGH

Supreme Court of the state of Maine put the Central Maine Power Co on flow-through and said, "We are unable to find an intent on the part of Congress that the ratepayers of a regulated utility should provide an interest-free loan to the company through present payment of a deferred tax." The commission had ruled that there was a permanent tax savings in the case of a growing utility and it concluded that Central Maine was such a company.

The Missouri PUC set the flow-through method for the Union Electric Co, emphasizing that by going to flow-through accounting there would be a matching of current expenses with current revenues.

Utility Commission of New York issued a general statement of policy on March 30, 1959. The statement said that utilities availing themselves of the liberalized provisions of Section 167 stand to obtain substantial benefits, that utilities should take all legitimate steps to reduce their tax burdens, and that the commission's policy will be to allow in rate cases no more than the actual taxes paid. The statement continued, "Commission should encourage this tax saving and in future rate proceedings this element, intangible as it may be, will be given consideration."

In Pennsylvania, the Superior Court affirmed a commission decision in favor of flow-through in the Manufacturers Light & Heat Co case, and found:

- Congress did not intend as a matter of law that the tax benefits from liberalized depreciation be retained by regulated utilities.
- It could not be said categorically that present customers will benefit at the expense of future customers.

The commission said, ". . . it is our present opinion that regulatory procedure requires the tax effect of accelerated depreciation be accorded the same treatment for accounting and rate purposes."

Judging by the more recent rate cases, there seems to be a slim trend on the part of the state commissions toward the flow-through treatment. But from an over-all view, the picture is still one of confusion. And highlighting this confusion is a California commission decision made after the Stone and Webster study had gone to press. In a 3 to 2 verdict, the commission ruled that all companies presently normalizing taxes will transfer such accruals to depreciation reserve. It further noted that such companies which continue to normalize ". . . shall for each year beginning in 1960, and continuing until its rates for service shall have been fixed on that basis, charge income for such a year and credit depreciation reserve accounts with amounts equal to the tax differentials, or savings, resulting from the use of liberalized depreciation methods instead of normal straight line depreciation methods in computing federal income taxes." The commission added, however, that this did not constitute an acceptance of normalization.

entirely new and different

UPTEGRAFF "compact" U-65 TRANSFORMERS

built for 65° C temperature rise

lower price
lower ratio of losses
greater endurance

see following pages for details

YOU SAVE 3 WAYS

with Uptegraff U-65 Transformers

Designed for operation at 65°C rise, the new Uptegraff Transformers incorporate three related engineering innovations:

- *reduction in size*
- *low ratio of full load copper loss to core loss*
- *introduction of high temperature insulating materials*

With the U-65's, there is no sacrifice in transformer performance and they bring the following *extra* benefits:

1

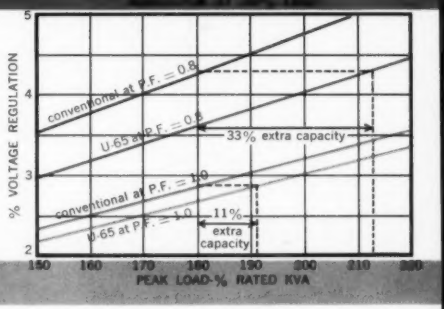
LOWER PRICE

Being more compact, the Uptegraff U-65 series of distribution transformers require less copper, steel, oil and other materials, permitting a saving which is passed along to the purchaser. Price savings may be as much as 7½%.

2

LOWER RATIO OF LOSSES

Operating economy in overloading is promoted by the lower loss ratio of the U-65 design. There is less voltage drop at peak load, and efficiency is high. This means greater customer satisfaction, greater tolerance for future load growth, greater operating revenue.



3

GREATER ENDURANCE

The new high-temperature insulation used in U-65 transformers has capacity for thermal endurance far exceeding the need of the higher temperature rating and the improved voltage regulation. Actually, the U-65 is one of the most conservatively-designed transformers offered today.

WHY THE 65° RATING?

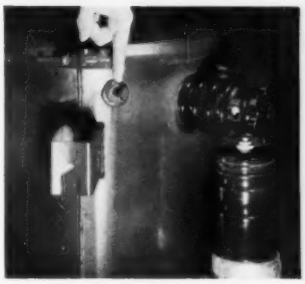
Instead of offering a dual rated 55°/65° transformer, Uptegraff has developed the U-65 line, in standard NEMA ratings. Being designed and built for 65° operation, they provide better efficiency, better ratio of losses, lower cost.

UPTEGRAFF U-65 TRANSFORMERS
have many unique features

High-temperature insulating materials

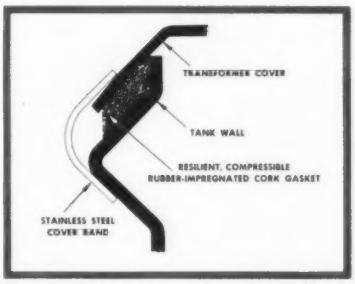
Five to ten times the endurance of conventional insulations at elevated temperatures is achieved through the use of epoxy insulated magnet wire rated for 150° C, special cyanoethylated kraft paper and high-temperature inhibited oil. Since the 65° design does not require more than twice the endurance of conventional materials, the New Uptegraff U-65 transformers, containing high temperature materials are actually more conservatively engineered than the conventional designs presently found acceptable.

Exclusive provision for pressure testing



Photograph shows a special fitting by means of which a pressure test with dry air at 3 to 5 psi is made on every completed transformer. With this test, exclusive with Uptegraff, leaks which might not be discovered by the standard "inversion" tests are quickly detected.

Tight, reusable tank seals

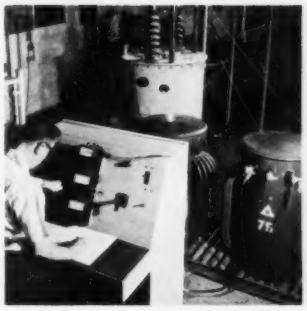


A resilient, rubber-impregnated cork gasket is firmly and uniformly compressed between tank wall and tank cover by a special steel cover band — locking out air, moisture and other contaminating influences. Gasket is cemented to tank. Cover, may be removed repeatedly without changing gaskets.

Easy and safe to handle and store

Uptegraff transformers are housed in palletized, rugged wooden crates for easy and safe handling, shipment and storage.

Every transformer fully tested



In addition to normal NEMA tests, a whole series of tests is applied on *every* transformer to assure mechanical and electrical integrity. These include checking core loss and exciting current, high-voltage impulse tests, and high-potential tests. There is no "sample" testing of Uptegraff transformers.

Low-loss core steel

Carefully selected M5W grain-oriented strip steel for wound core construction assures low exciting current and reduces weight and bulk.

New, tough cover coating

On transformers 7200 volts and over, the covers are plastic coated by a powder fluidizing process, providing exceptional protection from atmospheric conditions, wildlife and other hazards. Insulates for 20,000 volts. Endures a salt spray test of over 10,000 hours.

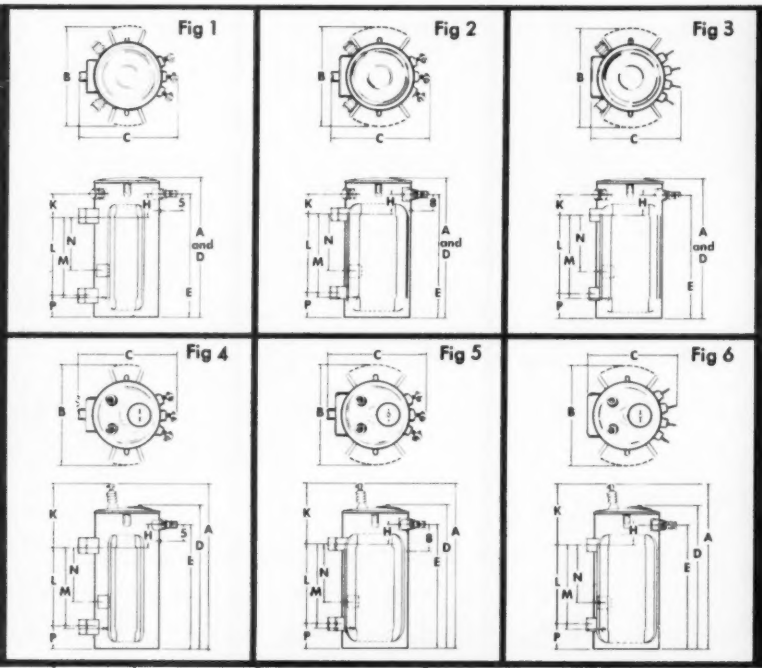
RECENT ARTICLES relating details of design as employed in the new U-65 transformers include:

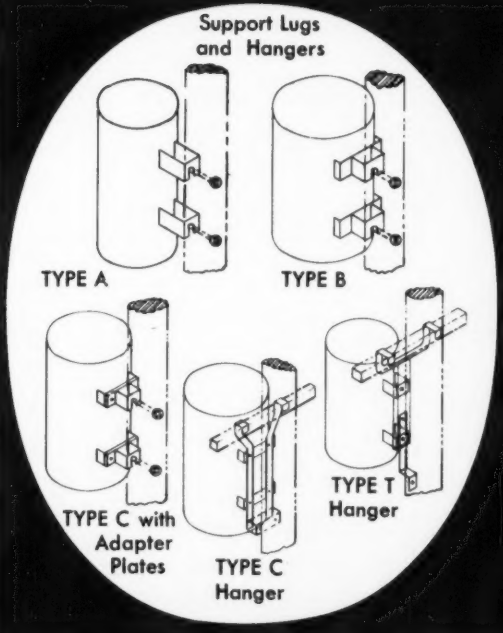
1. "Cyanoethylated Kraft-A Thermally Upgraded Cellulose for Transformer Applications" AIEE Conference Paper No. 5038.

2. "Reduced Loss Ratio Transformer Saves in Distribution Operation" by A. M. Lockie; ELECTRICAL WORLD, October 3, 1960.

3. "Transformer Losses and Loss Ratios" by Kenneth W. Klein, Cleveland Electric Illuminating Co., in ELECTRIC LIGHT AND POWER, July 15, 1960.

Electrical and Mechanical Characteristics of Uptegraff's new money-saving U-65 transformers





HIGH VOLTAGE RATING	LOW VOLTAGE RATING	KVA	LOSSES (WATTS)		PERCENT EFFICIENCY				PERCENT REGULATION		PER-CENT IMPED-ANCE	FIG. NO.	APPROX. DIMENSIONS (INS.)				NET WEIGHT (LBS.)		INTERCHANGEABILITY DIMENSIONS (INS.)						NEMA SUP-PORT LUG	NEMA CROSS-ARM HANGER
			No Load	Total	Full Load	¾ Load	½ Load	¼ Load	1.0 P.F.	0.8 P.F.			A	B	C	D	Without Oil	With Oil	E	H	K	L	M	N	P		
2400/4160Y (B.I.L.-60KV)	120/240 OR 240/480	10	56	201	98.0	98.2	98.1	97.4	1.5	1.8	1.8	1*	24¼	19⅞	19⅞	24¼	170	225	20	2	2	11¼	12	15	6¾	A	T1*
		25	122	434	98.3	98.4	98.4	97.8	1.3	1.7	1.7	1*	30½	21	22⅞	30½	295	400	26	2	2	11¼	12	15	12¾	A	T1
		50	205	740	98.5	98.6	98.6	98.1	1.2	1.8	1.8	1	38½	26½	26½	38½	505	710	34	7	7	23¼	24	15	3¾	B	T2
		100	405	1435	98.5	98.7	98.6	98.1	1.1	1.6	1.6	2	40¾	30¾	30¾	40¾	885	1150	35	7	7	23¼	24	15	4¾	B	T2
		167	725	2260	98.6	98.7	98.7	98.0	1.0	1.9	2.1	3	44¾	31¾	32¾	44¾	1350	1660	37	7	7	24	24	15	6	C	C1
4160/7200Y OR 4800/8320Y OR 2400/4160Y X 4800/8320Y (B.I.L.-75KV)	120/240 OR 240/480	10	56	216	97.9	98.1	98.0	97.4	1.6	1.9	1.9	1*	24¼	19⅞	19⅞	24¼	175	230	20	2	2	11¼	12	15	6¾	A	T1
		25	122	467	98.1	98.3	98.3	97.7	1.4	1.8	1.8	1*	30½	21	22⅞	30½	300	405	26	2	2	11¼	12	15	12¾	A	T1
		50	205	805	98.4	98.5	98.5	98.0	1.2	1.8	1.8	1	38½	26½	26½	38½	510	715	34	7	7	23¼	24	15	3¾	B	T2
		100	405	1485	98.5	98.6	98.6	98.1	1.1	1.6	1.6	2	40¾	30¾	30¾	40¾	890	1155	35	7	7	23¼	24	15	4¾	B	T2
		167	725	2295	98.6	98.7	98.7	98.0	1.0	2.0	2.2	3	44¾	31¾	32¾	44¾	1355	1665	37	7	7	24	24	15	6	C	C1
7200/12470Y OR 7620/13200Y (B.I.L.-95KV)	120/240 OR 240/480	10	67	241	97.6	97.8	97.8	97.0	1.8	2.0	2.0	4*	32	17¾	19⅞	26½	180	235	20	2	14	11¼	12	15	6¾	A	T1
		25	141	501	98.0	98.2	98.1	97.4	1.5	2.0	2.0	4*	38	19¾	22⅞	32½	305	410	26	2	14	11¼	12	15	12¾	A	T1
		50	235	840	98.3	98.5	98.4	97.8	1.3	1.8	1.9	4	46	26½	26½	40¾	520	725	34	7	19	23¼	24	15	3¾	B	T2
		100	430	1515	98.5	98.6	98.6	98.0	1.1	1.7	1.7	5	48¼	30¾	30¾	42¾	900	1165	35	7	20¼	23¼	24	15	4¾	B	T2
		167	750	2295	98.6	98.7	98.6	98.0	1.0	2.2	2.5	6	52¼	31¾	32¾	46¾	1375	1685	37	7	20¼	24	24	15	6	C	C1
12000 OR 13200 OR 13800 OR 14400 (B.I.L.-95KV)	120/240 OR 240/480	10	67	245	97.6	97.8	97.8	96.9	1.8	2.3	2.3	4*	32	17¾	19⅞	26½	180	235	20	2	14	11¼	12	15	6¾	A	T1
		25	141	506	98.0	98.1	98.1	97.4	1.5	2.0	2.0	4*	38	19¾	22⅞	32½	305	410	26	2	14	11¼	12	15	12¾	A	T1
		50	235	860	98.3	98.4	98.4	97.8	1.3	1.9	1.9	4	46	26½	26½	40¾	520	725	34	7	19	23¼	24	15	3¾	B	T2
		100	430	1530	98.5	98.6	98.6	98.0	1.2	2.0	2.1	5	48¼	30¾	30¾	42¾	900	1165	35	7	20¼	23¼	24	15	4¾	B	T2
		167	750	2295	98.6	98.7	98.6	98.0	1.0	2.2	2.5	6	52¼	31¾	32¾	46¾	1375	1685	37	7	20¼	24	24	15	6	C	C1

*No cooling tubes required.

R. E. UPTEGRAFF MANUFACTURING COMPANY

Scottdale, Pennsylvania

Representatives in Principal Cities

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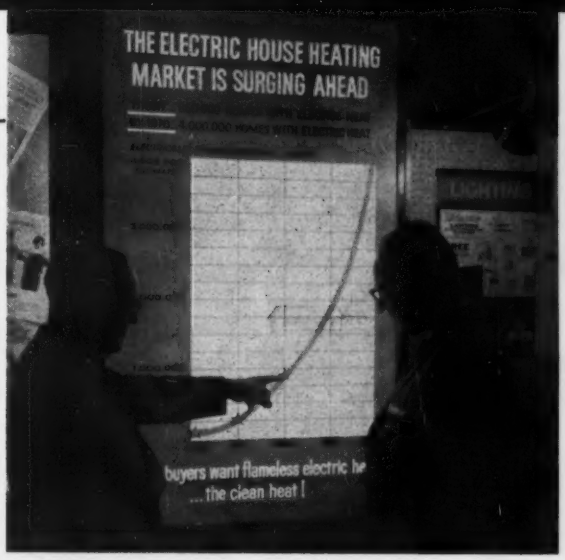
FARM

EEI Sales Conference Hears Recession Is About Over But Competition Still Exists



ELECTRIC HEATING growth is examined by John L. McEachin (left), Minnesota P&L, and Don Willis, Arizona PS

"This is it! We have had it. We are coming out of the recession."

This was the best news to come out of the Edison Electric Institute's 27th Annual Sales Conference held March 20-22 at Chicago's Edgewater Beach Hotel. It came from Dr Pierre Rinfret, director of economics department of the Lionel D. Edie Co.

Discussing the recession, Dr Rinfret said that it was an inventory recession, as every recession in the post-war period had been. "Therefore," he said, "American industry is trying to get rid of inventories. The retailer has the lowest inventory sales ratio he's had since 1947." Rinfret cautioned, however, that the recession will not end until the end of the third quarter, but that inventory policies are changing and just as they brought on the recession so now are they bringing on the recovery.

No Government Assistance Needed

And, he said, the recovery has been done completely without any form of government assistance.

Furthermore, "By the end of 1961 we will once again be smashing many economic records . . ." he pointed out.

What's ahead for the Sixties then? According to Dr Rinfret, the country will grow for the next four years, though perhaps not at a rate quite equal to the 1947-1955 rate. "Beyond the middle of the decade, it is reasonable to expect a substantial step-up in the rate of economic growth," he said.

"If we continue to grow the way we are and if we can accelerate our growth rate beyond 1965, the Russians won't bury us, we'll bury them . . . under a free enterprise system," he concluded.

Some of the ways utilities are going to tap this growth formed the basis of most of the rest of the speeches and side discussions at Chicago.

One problem which came up again and again however was competition. Competition from the gas industry, from the government and from foreign markets.

Sherman R. Knapp, president of EEI, and of the Connecticut Light & Power Co, said he feels the electric industry still has a long way to go if it expects to attain public support and understanding which will make it possible to eliminate the "gross inequities that exist in our efforts to compete with subsidized government power. We need to increase our efforts, particularly at the local level," he said.

Knapp feels that the sales forces of the shareholder public utilities are really what set them apart from government power operations. "Selling marks the difference between a business that stimulates mutual growth of customer and company—and government power thinking that says, 'Well, it's there if you want it.' "

Knapp pointed out that the assets of the member companies of EEI total approximately $50 billion, and these companies have construction programs which involve the annual expenditure of approximately $3.3 billion in 1960 to an estimated rate of $6 billion by 1970 for new facilities to meet growing demand.

Understand Power Pooling Situation

He also said that it is important that everyone in the utility industry understand the situation in respect to power pooling and high-voltage, high-capacity transmission interconnections.

". . . We are going more and more to the idea of regional planning and operation. Undoubtedly, inter-regional transmission ties will become more and more prominent and large blocks of power flowing over international boundaries will not be uncommon in the future."

Edwin Vennard, vice president and managing director of EEI, also viewed government competition, and opinioned, "There is nothing to indicate that all the power capacity in America cannot be financed in the free market. There is no need for the government to furnish power facilities." Nor in the foreseeable future, he said. "It can all be financed through the sales of free investors."

He called the electrical industry "a very stable one" and attributed it to the "salesmanship" of those present. The expenditure for new plant continues at a substan-

LITHO IN U.S.A.

INDUSTRY PROGRAMS such as Farm Better Electrically are spearheading industry drive to capture consumer market

tial rate year after year even through recessions when similar expenditures for other industries may drop, he said.

"The new investment in power facilities is running at the rate of about $3.3 billion per year," according to Vennard. "This is on the average of about 10% of all new construction of all businesses in America. And this new investment each year is equivalent to about 1½ times the power investment of TVA. It is like building one-and-one-half new TVA's every year."

Construction of new power facilities will require $52 billion additional during 1960-1970, and $91 billion more between 1970 and 1980, he said.

But plans for the future depend on utilities continuing to sell as aggressively as in the past. Sales expenditures can be increased to the amount being spent in 1937, Vennard said, which was about 2.5¢ per dollar of revenue, provided a balanced load is sold at a proper price.

Chief executives will be willing to increase sales expenditure if they are shown how this increase can work to improve percent return, he concluded.

To fight competition, don't let it be reduced to general name calling . . . to scare and fear promotion. This only serves to convince the customer of the failings of the competing product and does nothing to build the market.

"Let's not design our competition to hurt our competitor, let's design it to obtain business for us," was the view of Claude D. Lawrence, chairman of the EEI Sales Division Executive Committee.

"Certainly in all areas of competition electricity has virtues which will allow at least retention and usually growth of its share of the business," he said. Our advertising must effectively present these virtues and promote sales when buying decisions are made. The proper exploitation of the 'flameless' idea is positive selling that suggests important and believable benefits."

Lawrence, of course, was referring to the Live Better Electrically Program and its "flameless" approach. This will continue in advertising in 1961 and in 1962, too, W. M. Shepherd, chairman of the LBE Policy Committee, told the conference.

A third kind of competition is foreign competition. While not affecting utilities directly, it does affect their customers. Foreign competition must be considered, because production costs are going up continuously and therefore some increase in productivity must be secured to make up for these higher costs. "This problem is further accentuated if we consider foreign competition," said George W. Jernstedt, manager of manufacturing planning for Westinghouse Electric Corp.

The advantages foreign competition has over the US are low cost of labor and enthusiasm. "We must focus more attention on continuously improving our methods and equipment. This is especially true if we expect to be competitive in the year ahead. If you help your customer now to progressively mechanize, you can open the way to his continuous improvement in productivity and lower costs. He can then look forward to being better off in 1965 . . ." Jernstedt said.

He also predicted that automation is on the way in. "If we now accept the premise that we must continuously improve our manufacturing equipment and methods, it isn't too difficult to conclude that automation is the direction we must go," he pointed out. But proper planning is necessary if equipment bought today will fit into requirements of a year or two hence.

Get Top Management Support

The necessity for keeping top management informed of utility sales plans and even for bringing them into the actual workings came from two sources.

In talking about a nine-point program his company has to capture commercial cooking sales, Commonwealth Edison Co's Murray Joslin said, "For a successful program you must have the support of top management from the chairman on down to the men on the firing line. Our chairman has helped sell several of our new installations."

Farm power men have a responsibility for keeping management informed if it expects to build rural sales, according to V. L. Schreiber, product development manager of the New Hollard Machine Co.

If rural marketing men of utilities are going to service this vital farm market adequately, they will have to keep their managements well informed of changing practices in the farm picture that can effect basic decisions, he said.

Although many important sales topics were not discussed at this year's conference, one which got a lot of attention was lighting.

Lighting contributes about 35% of the utilities' residential revenue, according to Herbert Main, Potomac Electric Power Co's manager of business research, and chairman of the Load Research Committee, Assn of Edison Illuminating Companies.

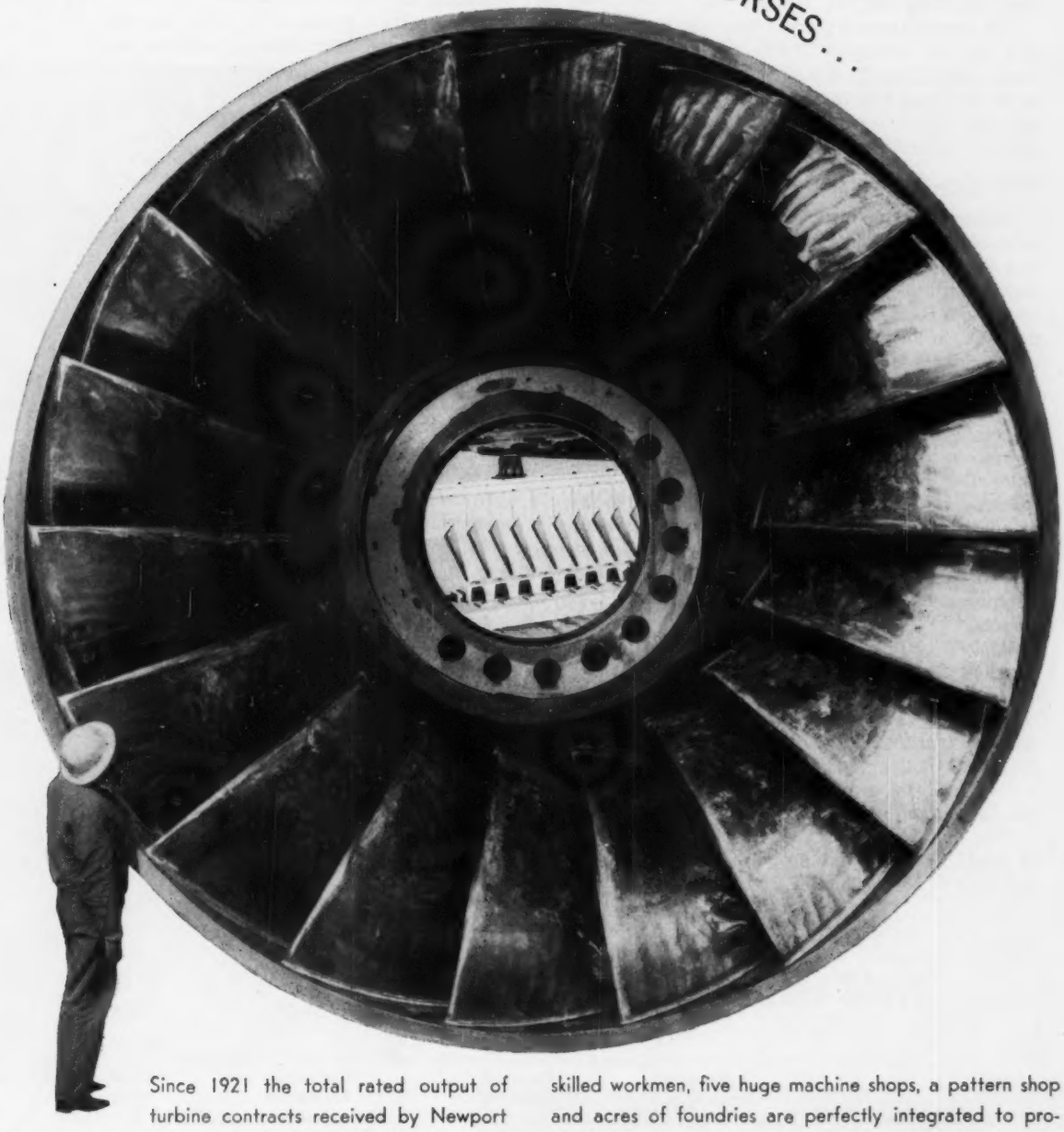
This fact came out of a National Residential Lighting Survey made by Middle West Service Co for the General Electric Co.

Twenty-two utilities each selected approximately

(*Continued on page* 152)

EEI Sales Conference (*Continued from page* 150)

NEWPORT NEWS HARNESSES 12,000,000 HORSES...



Since 1921 the total rated output of turbine contracts received by Newport News exceeds 12,000,000 horsepower. The Niagara Project, Grand Coulee, Hoover and Chief Joseph are but a few of the installations for which Newport News has designed and built such equipment as hydraulic turbines, valves, gates and penstocks.

Newport News has the men . . . the methods . . . and the machines to take gigantic jobs like these in stride. Large engineering and design staffs, hundreds of highly skilled workmen, five huge machine shops, a pattern shop and acres of foundries are perfectly integrated to produce large units in the shortest possible time . . . from water power equipment to wind tunnels, from cracking towers to paper dryer rolls.

Look to Newport News with its seventy-five years of metal fabricating experience. Your inquiries are invited.

Newport News
SHIPBUILDING AND DRY DOCK CO.
NEWPORT NEWS, VIRGINIA

six test homes which were then separately metered. The sample resulted in an average test home of 5.5 rooms with a total of 1,048 sq ft of floor area; an average family of 3.8 persons, 30.5 lamps with an average of 82.6 w per lamp, and 2,687 w of connected load, including exterior lighting.

The annual average use per customer for lighting was 854 kw and averaged 21.8% of the total electrical usage. But if the 21.8% lighting segment is assumed to be the basic non-competitive load in the home and uses the initial blocks of the rate structure, the 35% figure is deduced, Main said.

CL&P Runs 'Streamlighted' Promotion

Meanwhile, Connecticut Light & Power Co got a total of $310,000 in EAR ($258,000 from relighting and $52,000 from air conditioning) from 1,529 commercial customers at a cost of slightly over 1% of the first year's EAR, from a "streamlighted block" promotion. Or, according to C. W. McCormick, commercial sales manager for CL&P, 25% of the added commercial revenue came from only 5% of the customers.

The company's initial approach was to concentrate its selling effort among merchants in one block of a downtown area or along one street in smaller towns. After the block was "streamlighted" the company followed up with promotion among other merchants of office lighting, building floodlighting, and storefront "showcase" lighting, all to the higher Illuminating Engineering Society standards. Air conditioning was also promoted as a necessary part of integrated modernization.

Further emphasis on the commercial market was explored by Westinghouse Electric Corp Vice President W. W. Sproul Jr.

The electrical industry should mobilize its resources now to expand the "total electric approach" to include the entire building construction industry, he said.

"We have no comprehensive approach to the commercial market," he said.

"We must stop marching down the separate paths of product-oriented promotions. I know that now is the time to think Total Electric and sell (it) to our commercial customers. And I'm including apartments, schools, office and public buildings, along with commercial buildings." If the Total Electric approach is applied to all buildings, in the next ten years new construction will equal the value of all buildings now standing, he pointed out.

Sproul then proposed a joint venture—organized on a national scale between utilities and interested manufacturers, whose purpose would be to "convince every important segment of the commercial construction and modernization market of the benefits of the Total Electric concept."

Measurement Should Be Considered

Far-reaching changes in government, business, marketing and management are going to take place in the coming 20 years and it is this prospect that justifies considering the subject of measurement, according to Karl H. Rudolph, Cleveland Electric Illuminating Co. "Often it is the understanding of how well we perform that improves the result we achieve," he said.

Performance measurement consists of three processes: Measuring, comparing and interpreting. And there are three standards against which performance can be measured: Historical, market and engineered.

By comparing current performance with past performance one can begin to appraise the quality of performance, he said. "Such a comparison tells us whether or not we're improving. This historical measure is valuable because it does reveal a trend. It will tell us whether or not specific efforts are producing desired results, and it will point up the areas in which further analysis or effort is needed."

Market standard provides a comparison of performance with what other companies have done in the same area.

Engineered standard provides a comparison of performance with what it realistically should be, taking all factors into consideration.

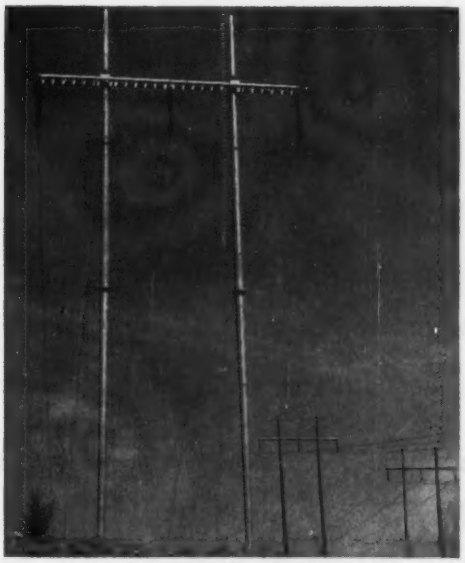
The engineered standard is the most objective kind and hence the most reliable indicator of performance, but unfortunately there are none in marketing yet, Rudolph commented.

1960 EEI Sales Promotion Awards

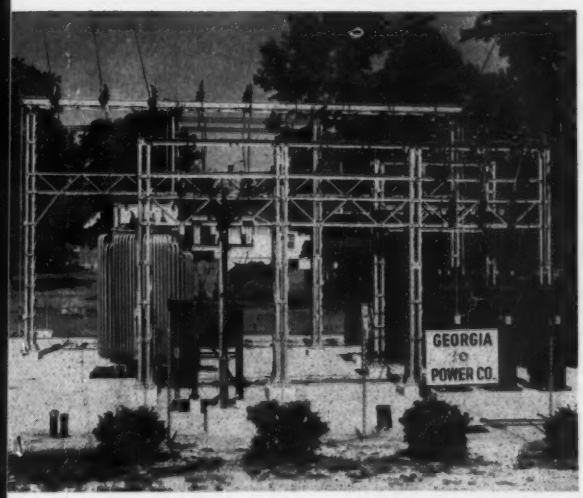
	Class A[1]		Class B[2]	
	Individual Promotion	Over-all Program	Individual Promotion	Over-all Program
Residential Market.....	Duke Power Co	Pacific Gas & Electric Co	Indiana & Michigan Electric Co	Florida Power Corp
Commercial Market....	Ohio Power Co	Alabama Power Co	Central Power & Light Co	Jersey Central Power & Light Co
Farm Market.....	Wisconsin Power & Light Co	Alabama Power Co	Dayton Power & Light Co	Ohio Edison Co
Industrial Market.....	West Penn Power Co	Alabama Power Co	Toledo Edison Co	Jersey Central Power & Light Co

[1] Over 300,000 customers (except Farm Market which is over 30,000 customers)
[2] Under 300,000 customers (except Farm Market which is under 30,000 customers)

Steel helps GEORGIA POWER to keep up with the fastest growing area in the nation



Tubular pole for 230 kv aerial transmission line. Only 3.4 poles per mile are needed.



The Atlanta airport distribution substation is typical of Georgia Power's 1,166 smaller stations. There are approximately 16,000 lbs. of steel in the station. Georgia Power system covers 90% of Georgia.

Larger substations, like the Hapeville Substation, use about 122,000 lbs. of steel. Georgia Power has 1,322 stations with a total capacity of 9,859,500 KVA.

This mark tells you a product is made of modern, dependable Steel.

Everything is growing fast in Georgia. Personal incomes are increasing 82% faster than the national average. Population has jumped more than 10% in 10 years. Power consumption is growing too . . . every day 66 new customers are added. To keep ahead of the rising demand for electricity, Georgia Power increased their generating capacity to almost 2 million kilowatts. Their capacity is growing at twice the national average. And all this has been done without a rate increase.

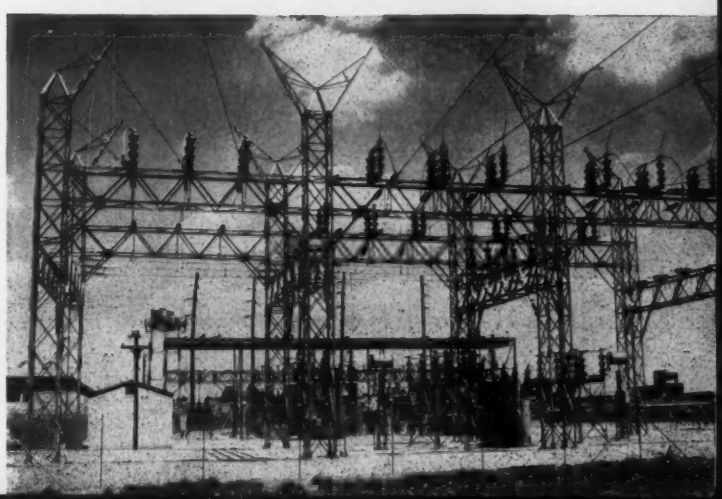
Georgia Power uses steel to keep costs down, profits up. They build all permanent substations of steel because nothing is as economical as steel. It's easy and fast to erect, needs little maintenance. Some substations have gone 43 years without repainting.

For 230 KV lines, Georgia Power uses a tubular steel "H" structure of its own design, thereby cutting one-third off the cost of erecting conventional towers. The poles are made of steel because only steel gives lower first cost plus long term economy. Steel structures can go years without maintenance.

Steel serves you best. Designing with steel gives you proven dependability for years of satisfactory service. For more information, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

United States Steel Corporation • Columbia-Geneva Steel Division • Tennessee Coal & Iron Division • United States Steel Supply Division • United States Steel Export Company

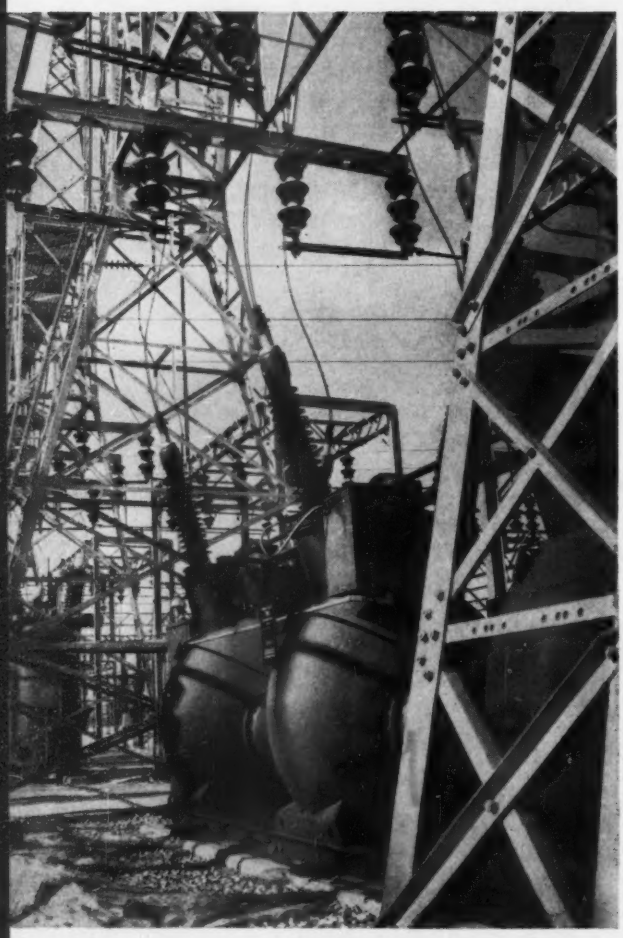
USS TRADEMARK **United States Steel**



This mark tells you a product is made of modern, dependable Steel.

Four steels that will help you design

A7 and A36 Structural Carbon Steels . . . USS COR-TEN and USS transmission towers involves choosing the materials that will do the best efficient material you can use because you can design to meet specific levels and three degrees of atmospheric corrosion resistance. All have larger structures to reduce weight, add strength, or increase durability.



ASTM A7
Structural Carbon Steel

In the galvanized form this steel has been used more often than any other material. When galvanized it has excellent corrosion resistance and gives long service life under nearly all conditions. Its minimum yield point is 33,000 psi.

ASTM 36
Structural Carbon Steel

This is a new, stronger carbon steel with a minimum yield point of 36,000 psi—9.1% higher than ASTM A7 structural steel. It will allow an increased design stress of almost 10% with significant cost savings in fabricated and erected structures. This steel is also used in the galvanized condition.

USS MAN-TEN
High Strength Steel

50% stronger than A7 structural carbon steel, USS MAN-TEN Steel is the lowest in cost of the high strength steels. In the uncoated condition it has atmospheric corrosion resistance about double that of carbon steel. It permits weight reductions up to 33%, and results in lower costs when weight savings are as low as 17%. Galvanized MAN-TEN Steel is recommended for large substations and towers where extra strength without additional weight is needed. Minimum yield point is 50,000 psi.

more efficient substations at lower cost

MAN-TEN High Strength Steels. An efficient design for substations or job at the lowest annual cost. Steel, with its different grades, is the most requirements. The four steels mentioned above offer three different strength good fatigue strength and the high strength steels can be used in the Here are the advantages of each type of steel:

USS COR-TEN
High-Strength Low-Alloy Steel

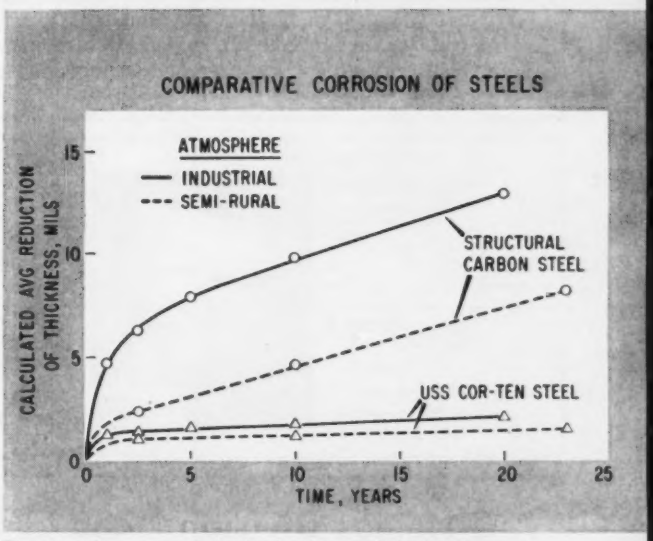
This is the original high-strength low-alloy steel that offers atmospheric corrosion resistance of four to six times that of structural carbon steel. COR-TEN Steel's corrosion resistance is so superior that it may be used bare without coating or painting. That's because COR-TEN Steel develops an oxide coating which adheres with extreme tightness and does not flake off. Moisture cannot penetrate this smooth, dense oxide so that further corrosion is greatly impeded.

Exposure tests on bare COR-TEN Steel, conducted continuously since 1935, show that it loses very little weight after the first two years. Thin COR-TEN Steel sheets, 0.0298" thick, exposed to corrosive atmosphere for 25 years, are still almost as good as new.

Bare COR-TEN Steel transmission tower structural members installed 12 years ago in Chicago's industrial atmosphere have shown no measurable loss of thickness.

The fact that COR-TEN Steel can be used uncoated will save untold thousands of maintenance dollars for any utility where atmospheric corrosion poses a maintenance problem. Its high minimum yield point of 50,000 psi permits large structures to be built lighter in weight without sacrifice of strength or durability. *USS, COR-TEN, MAN-TEN are registered trademarks*

For complete technical information on any of this family of cost-reducing steels for electrical construction, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.



Time-corrosion curves of structural carbon steel sheet and USS COR-TEN Steel sheet showing superior corrosion resistance of COR-TEN in industrial and semi-rural atmospheres.

United States Steel Corporation • Columbia-Geneva Steel Division • Tennessee Coal & Iron Division • United States Steel Supply Division • United States Steel Export Company

USS United States Steel

Central Power & Light Appoints Chairman

BATES

JOSLIN

J. L. Bates has moved up to the post of chairman and E. S. Joslin to general manager at Central Power & Light Co. Bates is also president and Joslin is a vice president.

Bates has been with the Texas utility since 1923. He became a vice president in 1939 and general manager the following year. In 1954 he was elected president.

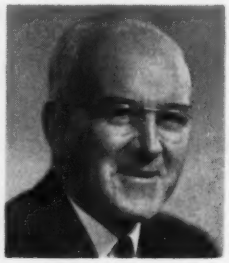
Joslin began with Central P&L in 1927 as a local office cashier. He later served as chief clerk, manager, and district manager in Corpus Christi, becoming vice president and Corpus Christi district manager in 1953. Central P&L named Joslin vice president in charge of operations last year.

Ontario Hydro Chairman Appointed

The new chairman of Hydro-Electric Power Commission of Ontario, following the resignation of James S. Duncan, is First Vice-Chairman W. Ross Strike. He takes office next month.

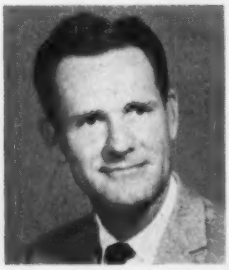
Strike became a member of the Commission in 1944, while serving as president of the Ontario Municipal Electric Assn.

Duncan, who is interested in the effects of communism on the West, plans an on-the-spot study of various countries.



◀ STRIKE

DUNN ▶



Dunn Boosted to Florida Power VP

Edgar H. Dunn Jr has been elected a vice president of Florida Power Corp. The attorney has been Florida Power's assistant general counsel since last year. He joined the company's legal department in 1955.

At the meeting at which Dunn was elected, President W. H. Clapp announced that Florida Power plans to spend $128 million for construction over the next three years.

A-C Names Division Head

Roy M. Casper will become general manager of Allis-Chalmers Manufacturing Co's power equipment division May 1, succeeding J. W. McMullen who is retiring after 45 years with the company.

Casper, who is a vice president, has been general manager of the atomic energy division since 1957. He was administrative assistant to the vice president in charge of Allis-Chalmers' Industries Group before that.

Myers Moves Up to Westinghouse VP

Carlisle P. Myers has become a vice president at Westinghouse Electric Corp.

He has been general counsel since 1955 and secretary for the last three years.

Myers will continue to direct the law department, including the new antitrust division. He will also continue as secretary.

With Westinghouse since 1948, Myers became head of the law department at Pittsburgh headquarters in 1952.

(*More News About People on page* 158)

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"By reason of special training, wide experience and tested ability, coupled with professional integrity the consulting engineer brings to his client detached engineering and economic advice that rises above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services, which do not replace but supplement and broaden those of regularly employed personnel, are justified on the ground that he saves his client more than he costs him."

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POWER PLANT SPECIALISTS
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PERSONAL BRIEFS

Fourteen members of the American Institute of Electrical Engineers have been elevated to the grade of Fellow for outstanding contributions to the profession: **William R. Clark,** Leeds & Northrup Co; **John W. Jones,** Philadelphia Electric Co; **Raymond C. Machler,** Leeds & Northrup; **Carl E. Asbury,** Commonwealth Associates, Inc; **Theron A. Brown,** Madison Gas & Electric Co; **A. J. Cooper,** Allis-Chalmers Manufacturing Co; **Reinhard K. Hellman,** Hazeltine Research Corp; **Joseph J. A. Jessel,** Bureau of Power, Federal Power Commission; **George A. Lewis,** Bureau of Reclamation; **Charles W. Maloney,** Stone & Webster Engineering Corp; **Whitney Matthews,** Goodard Space Flight Center; **Robert Nordell,** Sieverts Kabelverk; **Julian Rogoff,** Burndy Corp; and **Walter H. Sammis,** Edison Co.

John W. Scott has been named assistant administrator for administration at the Rural Electrification Administration.

Following the resignation of **Roger Courtland,** the National Rural Electric Cooperative Assn has named **Nake C. Lewis** as public relations director.

M. C. Boogher, vice president of Missouri Public Service Co, has been elected president of the Electric Assn of Kansas City.

Dr W. Howard Arnold has joined the staff of Nuclear Utility Services, Inc, as director of nuclear fuel management. **Donald L. Couchman** also joined NUS' technical staff.

General Electric Co has appointed **Charles F. Erlandsen** as manager of quality control at the Buffalo plant of the semiconductor products department. **Coleman Murdock** became Knoxville branch manager, replacing **Gayden Drew** who went to Birmingham as district television specialist. Also, GE named **Anthony J. Krystofik** as sales engineer for appliance timers in the appliance control department, and **W. N. Mobley** as manager-manufacturing in the fuels preparation department at Hanford.

In GE's silicone products department, **John H. Blomshield** has become manager, facilities design and construction; **Donald C. Kuhre** became manager, general accounting; and **Thomas H. Fitzgerald** was named manager of the east central sales district. GE's high voltage specialty transformer section promoted **G. E. Lewis** to manager of engineering, and **S. T. Maunder** to advanced engineering consultant. **Dr Sumio Yukawa** has been appointed manager of metallurgy and **Fred H. Kindl** became manager of electro-mechanical engineering, both in the materials and processes laboratory.

Richard B. Barton was named district manager, installation and service engineering department for GE's Pacific Southwest district. He succeeded **Philip L. Savage** who became consultant to the district I&SE manager.

Triangle Conduit & Cable Co, Inc, has appointed **William F. O'Connor** manager, electrical distributor sales; **William F. Coursen,** assistant manager for the Western region and **Joseph F. Barry,** assistant manager for the Eastern region, both for electrical distributor sales.

Albert H. Leader has been named vice president-sales of Sequoia Wire & Cable Co, subsidiary of Anaconda Wire & Cable Co.

Flintkote Co has appointed **H. L. Evans** vice president of general manufacturing.

Douglas K. Bogart has been named sales promotion manager of Preformed Line Products Co.

OBITUARIES

Randolph Halliday Nexsen, 75, retired chief of the Power Bureau of New York's Public Service Commission . . . **Albert Givan,** 84, former chief engineer and general manager of the Sacramento Municipal Utility District . . . **Frederick J. O'Malley,** 75, retired assistant superintendent of Philadelphia Electric Co's station operating maintenance division . . . **Frank S. Carlile,** 72, co-founder and former chairman of C&D Batteries division of Electric Autolite Co . . . **Everett H. Alexander,** 56, district manager of sales administration and planning at General Electric Co's apparatus sales division . . . **Louis D. Bliss,** founder and president, Bliss Electrical School.

Capacitors Boost 120/208-V Network Capability (*Continued from page* 55)

connected through a disconnect which will pick up 205-220 amp, depending on system voltage. This method of connecting and disconnecting fixed capacitors has worked successfully.

Outdoor installations have 90 1-kvar, 230-v, single-phase units in a 42 x 42 x 10.5-in. cabinet. The front of the cabinet opens to each side, with a locking arrangement at the top to hold the doors open. Units are prewired and delta-connected at the top to three staggered terminals where incoming and outgoing wires connect.

Because all outdoor banks are set in groups of three, a frame was designed to permit wiring between cabinets to be done before installation, thus saving time working from a ladder. The frame supports the assembly until the capacitors are secured to the wall.

The next step is to mount a 400-amp disconnect switch and wire it to the capacitor bank in 3-in. conduit. Then a 3-in. conduit is installed between the switch and a service box or manhole. After the cable is installed and connected through limiters to the network, the capacitor is placed in service by closing the switch. These wall units may be disconnected during winter or to reduce connected kvar.

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DISPLAYED RATE: ———RATES——— **UNDISPLAYED RATE:**

EMPLOYMENT OPPORTUNITIES: $25.50 per inch. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.
BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

FOR SALE

Brand new — Never installed motor varnish working oven. Designed for 1,000 #56 frame motors per shift. Will handle other sizes. Gas heat, electric controls, sell for 2/3 of cost.

FRANKLIN MANUFACTURING COMPANY
(Tooling Department)
65-22nd Avenue N. E., Minneapolis 18, Minnesota

ADDRESS BOX NO. REPLIES TO: Box No.
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Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 520 N. Michigan Ave.
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POSITIONS VACANT

Electrical Engineer—Excellent opportunity for graduate engineer to enter consulting field and grow with progressive Midwest concern. Board layout work—power, lighting, and control systems; calculations; and occasional field contacts. 3-5 years experience. Moving expenses paid. Send resume, including education, experience, and personal qualifications to P-6246, Electrical World.

An Investment!

Productive advertising is an INVESTMENT rather than an EXPENDITURE.

"Searchlight" advertisers almost invariably report prompt and satisfactory results.

BE CONVINCED — send us your advertisement TODAY.

Address Classified Advertising Division

ELECTRICAL WORLD
330 W. 42nd St., N. Y. 36, N. Y.

TRANSFORMERS

3—2500 KVA G-E 69000—2400/4160Y
3—2500 KVA G-E 69000—7200/12470Y
4—2500 KVA W-H 34500—2400/4800
3—1500 KVA G-E 69000—2400/4160Y
3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—1000 KVA G-E 34500-7200/12470Y
3— 500 KVA G-E 34500-2400/4160Y
3— 833 KVA W-H 43800—480
3— 667 KVA G-E 13800—2400
3— 333 KVA W-H 13200—2400/4160Y
3— 333 KVA G-E 2400/4160Y—240/480
3— 333 KVA Wag. 2400—120/240
1—1500/1875 KVA Mol. 3-Ph. 40,500—4800 F/C equipped
1—1500/1875 KVA Mol. 3-Ph. 34,500—2400 F/C equipped

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5316 Hetzel St.
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47 Years' Dependable Service

Unusual Opportunity for Young Engineer

Who possesses creative and design abilities in the line of small cranes and hydraulic truck equipment.

Established multi plant company expanding into new field of operation will offer this man the opportunity of developing his creative talents to the fullest extent. Advancement potentials unlimited in this newly formed division.

Location in the Great Lakes area. Send brief resume of past experience to:

P-6499, Electrical World
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UNUSED SUB STATION

3750 Kva Westinghouse transformer
High voltage — 24,100/23,500/22,900/22,300/21,700
Low voltage — 2400/4160
Complete with primary breaker and four 1200 amperes air blast breakers for secondary
Photos and complete description available.

EMPIRE ELECTRIC CO., INC.
5200 First Ave., Brooklyn 32, N. Y.
HYacinth 2-5555

BECHTEL

Power Plant Supervisor

Foreign Employment
KOREA

With at least 3 to 5 years recent experience as supervisor of operations and maintenance of steam electric generating plant with some experience in operations of a coal fired plant.

NO FAMILY HOUSING
Send resume to Personnel Manager

BECHTEL CORPORATION
220 Montgomery Street
San Francisco, Calif.

EXPERIENCED RELAY MAN

With at least 5 years working experience on protective relays, substation and plant control circuits. Telemetering, load control, and supervisory experience desirable. Engineering education required, degree not necessary. Age to 50. Headquarters in pleasant, gulf front city. Excellent wages and benefits. Company is one of fastest growing utilities in country. Reply with all detail in strict confidence.

Florida Power Corporation
Box 4042 St. Petersburg, Fla.
Attn: Mr. P. S. Herden, Employment Mgr.

ELECTRIC UTILITY MANAGER

International Utility Company wishes to assist in placing Executive forced to relocate through no fault of his own. Broad experience Management and Operations. Top references.

Please reply

PW-6592, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36 N.Y.

Meetings Calendar

APRIL

National Association of Electrical Distributors—53rd Annual Convention, Detroit, April 29-May 3.

Air Conditioning & Refrigeration Institute—Annual Meeting, The Homestead, Hot Springs, Va., April 30-May 3.

MAY

Illuminating Engineering Society—Intermountain Regional Conference, Hotel Utah, Salt Lake City, May 1-2.

Pennsylvania Electric Association—Systems Planning Committee, Hotel Alexander, Hagerstown, Maryland, May 1-2; Electrical Equipment Committee, Hotel Hershey, Hershey, Penn., May 4-5; Structures and Hydraulics, Hotel Yorktown, York, Penn., May 4-5; Prime Movers Committee, Bellevue Stratford Hotel and Eddystone Station, Philadelphia, May 11-12; Accident Prevention Committee, Port Jervis, N. Y., May 11-12; Meter Committee, Split Rock Lodge, Penn., May 11-12; Industrial Sales Conference, Skytop, Penn., May 11-12; Systems Operation Committee, Skytop, Penn., May 18-19; Street and Highway Lighting Committee, Wellsboro, Penn., May 18-19; Accounting Conference, Penn Sheraton, Pittsburgh, May 22-23; Customer Relations Conference, Hotel Hershey, Hershey, Penn., May 23-24; Relay Committee, Skytop, Penn., May 25-26; Motor Transportation, Hershey, Penn., May 25-26.

American Institute of Electrical Engineers—Rural Electrification Conference, Kentucky Hotel, Louisville, May 1-3; Packaging Industry Conference, New Ocean House, Swampscott, Mass., May 15-16; North Eastern District Meeting, Statler Hotel, Hartford, May 17-19; Fractional Horsepower Motors Conference, Biltmore Hotel, Dayton, May 23.

Alabama Electric Cooperative, Inc.—Annual Rural Electric Generating Cooperative Conference, Battle House Hotel, Mobile, Alabama, May 1-4.

• **Edison Electric Institute**—BLBS Executive Committee, New York, N. Y., May 2-3; BLBS Lighting Information Committee, Washington, D. C., May 5; Transportation Committee, Sheraton, Philadelphia, May 8-12; Electrical System and Equipment Committee, Hotel Roosevelt, N. Y., May 15-16; Purchasing and Stores Committee, 14th Annual Meeting, Shamrock-Hilton Hotel, Houston, Texas, May 15-17; Transmission and Distribution Committee, Netherland-Hilton Hotel, Cincinnati, May 18-19.

Electric Association of Chicago—Sixth Biennial Midwest Electrical Industry and Lighting Exposition, McCormick Place, Chicago 2-4.

Electric Components Conference—Sponsored by AIEE-IRE-EIA-WCEMA, Jack Tar Hotel, San Francisco, May 2-4.

ECAP—Copy Group, Leland Hotel, Detroit, Mich., May 3.

Midwest Association of Railroad & Utilities Commissioners—Hotel Lassen, Wichita, Kansas, May 3-5.

Southeastern Association of Railroad & Utilities Commissioners—Lafayette Hotel, Lexington, Kentucky, May 3-5.

• **American Gas Association**—Joint Meeting, Personnel Committee, New England Regional Utility Group and Employee Relations Committee of Electrical Council of New England, Sheraton Plaza, Boston, Mass., May 4-5.

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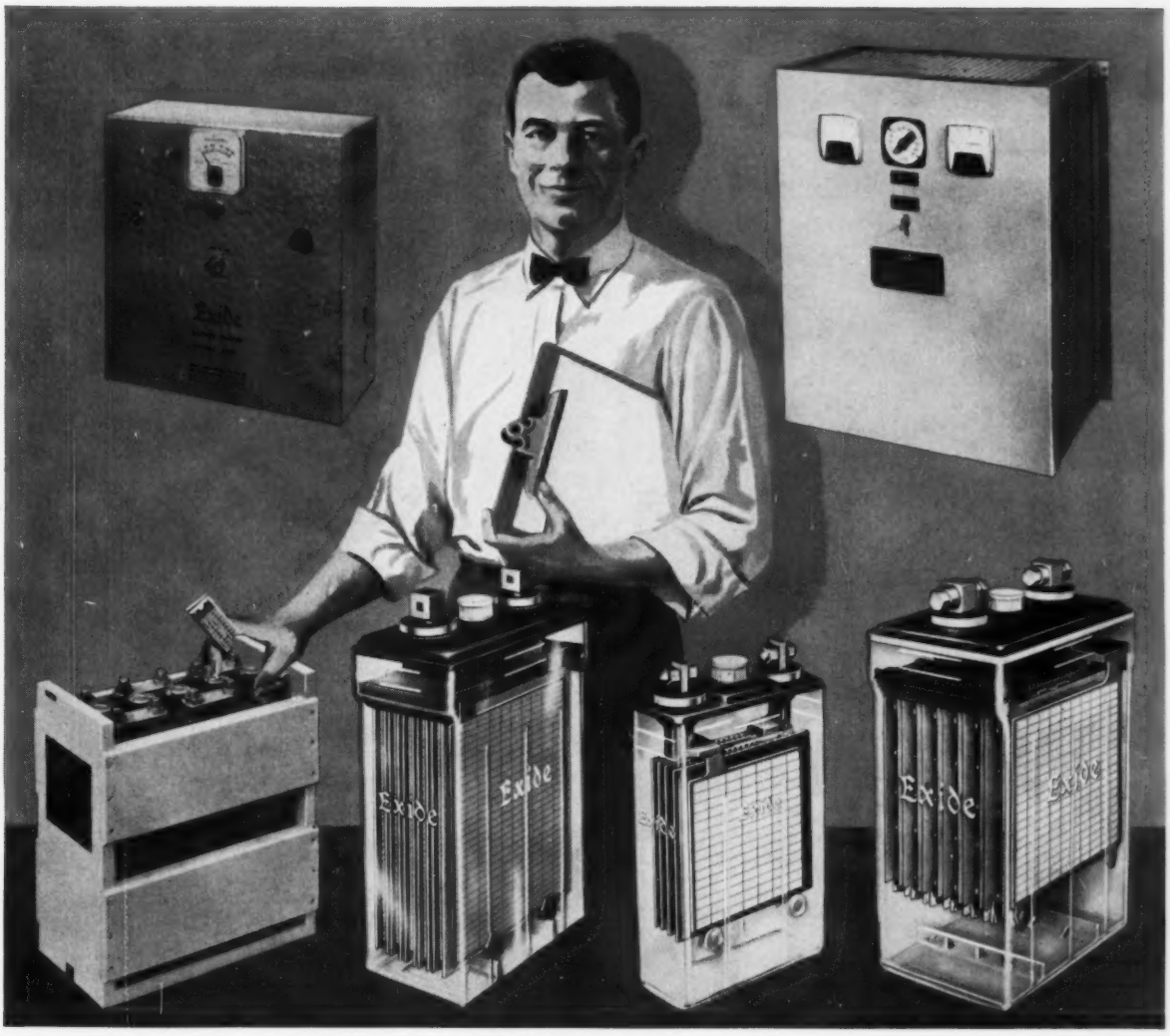

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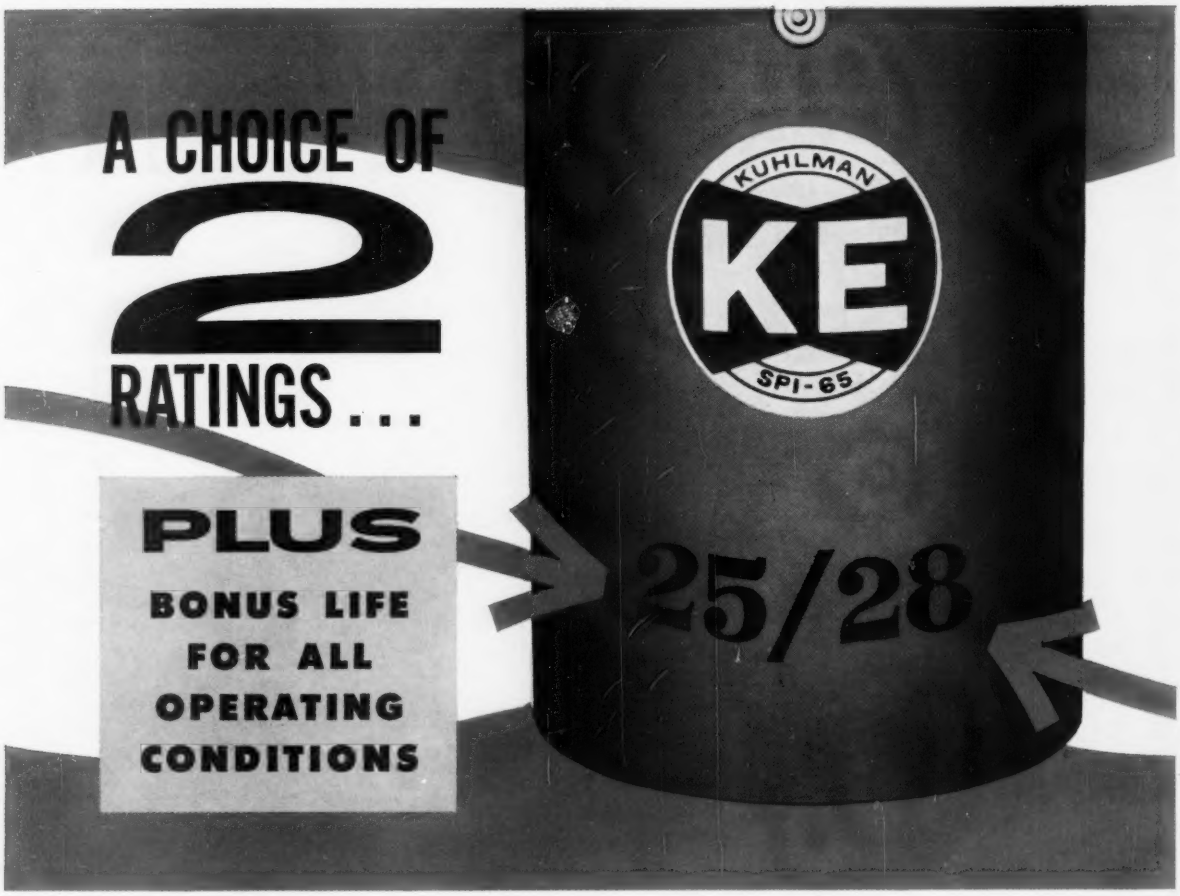

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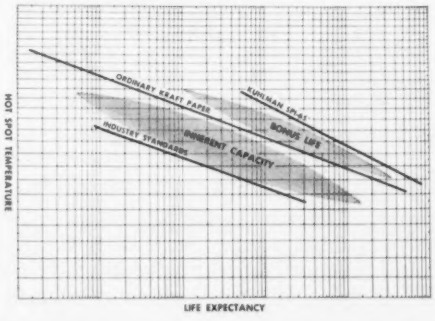

This life versus temperature test chart shows the inherent capacity and bonus life of Kuhlman transformers.

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